The
Electrical Review

VOL. CXIV. JANUARY 5, 1934. No. 2928.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, WATLOO, LONDON." Code, A B C. Telephone No.: Hop 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Principal Contents:

	PAGE
The New Regulations	1
Electrical Metal Production. By H. Williamson	4
The Physical Society's Exhibition	6
Safety and Sufficiency of Supply	12
Meetings and Discussions	13
Correspondence: This Prosperity; Electrifying North Wales; Variations in Distribution Voltages; An Ingenious Time Switch; Large High-speed Alternators; Earthing Electrodes; A Clothes-drying Suggestion	15
A New High-frequency Calorimeter	16
New Apparatus and Devices	17
Met.-Vick. Developments	18
English Electric Progress	19
The Work of the G.E.C.	19
New Books	20
Materials for the Electrical Industry. By L. H. Quin	21
Business and Industrial Notes	22
Electricity Supply	26
Traction	28
Communications	28
Contract Information	29
Notes	30
Our Personal Column	31
New Companies Registered	32
Returns of Electrical Companies	32
City Notes	33
Stocks and Shares	33
Published Specifications	35
New Work for Contractors	36

The New Regulations

THE new regulations for securing the safety of the public and ensuring a proper and sufficient supply of electrical energy which have just been issued by the Electricity Commissioners will come into force for existing undertakings after the end of this year. They modify in many important respects the regulations which they supersede, and have the force of an Act of Parliament.

The rearrangement of the clauses and their wording is a distinct improvement, and a good point is the official recognition given to the specifications of the British Standards Institution and the Wiring Rules of the Institution of Electrical Engineers. Their necessarily legal phraseology may prove a stumbling-block to some, so we have abbreviated them into "engineers' English" on another page.

The first thing that will be noticed is the more extensive power given to an undertaking to refuse to connect unsatisfactory installations. The giving of a supply no longer depends upon a vague satisfaction that the connection would not cause a leakage exceeding one ten-thousandth of the maximum current supplied, supplemented by the provision of the Acts that the supply should not cause a disturbance to other consumers. The undertaking can now disconnect the service immediately if the supply is improperly used, without the formalities previously required.

Some controversy is likely to be aroused by the prohibition of a three-wire or three-phase supply to a consumer with an installed capacity of less than 15 kW—a limit that is likely to upset the balance between phase or outer and neutral on many distribution systems. The prescribed limit seems high in view of the practical character of the precautions stipulated where a three-wire or four-wire service is allowed.

The safety of the consumer is, of course, of prime importance, but no rules yet published deal adequately with the use of portable appliances in the bathroom—the one weak spot. It is difficult to save a consumer from his folly, but we hope that the new I.E.E. Wiring Rules may be of some assistance.

The previous distinction between "h.t." and "e.h.t." has been dropped; the extension of the voltage range far beyond 3,000 V has deprived the dividing line of any significance it may once have had. With its elimination goes the requirement that the pressure of e.h.v. supplies should be declared at a minimum which was not to be exceeded by more than 12½ per cent., although existing arrangements will be maintained. This requirement was always illogical, as a small undertaking receiving a bulk supply had to maintain its distribution voltage between plus and minus 4 per cent. for distribution.

This range of permissible voltage variation is now to be increased to plus or minus 6 per cent. We have on previous occasions stated our objections to an increase, which we regard as a retrograde step. We should have preferred to retain the existing figure for urban supplies, with especial consideration for hard cases, which proverbially make bad law.

Electrical Honours

MR. P. J. PYBUS, M.P., M.I.E.E., who was for so many years closely connected with the affairs of the English Electric Co., Ltd., and was Minister of Transport from 1931 to 1933, figures prominently in the New Year Honours List. The electrical profession and industry will desire to congratulate him upon being made a baronet. Toward Sir George Douglas C. Newton, K.B.E., M.P., upon whom a barony has been conferred by His Majesty, the electricity supply industry in particular will also entertain similar sentiments, for Sir Douglas is a director of Edmundson's Electricity Corporation and of several associated power companies. Another name well known to the electrical world, and likely to so continue for many years, because of his chairmanship of celebrated committees on electricity supply and railway electrification, is that

of Lord Weir, who has been awarded a G.C.B. (Civil Division). Other gentlemen who appear in the List receive mention on our Personal page to-day.

Goodrich-Silvertown

WHEN announcing that he was handing over the chairmanship of the India Rubber Company, of Silvertown, to Sir Walrond Sinclair, the chairman of the British Goodrich Rubber Co., Ltd., Mr. B. H. Binder explained to shareholders last week that the agreement reached with the Goodrich Co. was the result of his conviction that the company required financial assistance and strengthened management. The agreement forms the basis of the capital reorganisation scheme, and the Goodrich Co. has arranged for the subscription at par for 100,000 new ordinary shares of £1 each, which carry the voting control. The controlling company will take over the Silvertown Co.'s empty Burton factory, though developments at Persan have not been settled upon, but it is at Silvertown and in the general organisation that it will find wider scope for rendering effective aid. It had been the intention of the Goodrich Co. to increase its own production space, but a programme for building new factories becomes unnecessary under the conditions created by the agreement. Mr. Binder cited the Goodrich-Silvertown plan as an example of co-operation and careful planning being better than unregulated competition. The I.R.G.P. & T. Works Co. held a substantial, profitable and reputable position in the electrical industry for very many years, and we hope that under the new control the good fortune of former days will return, though through a different class of product and activity.

Control Problems

ONE of our most pressing problems is to maintain the rupturing capacity of switchgear at the standard requisite to meet the severity of short-circuits under modern conditions. The switch must both make and break under the worst conditions likely to be met in practice. We are glad to hear that Messrs. Ferguson, Pailin, Ltd., for instance, are busy in replacing circuit-breakers which have become inadequate for their future work. One difficulty is the greater space required for the heavier duty gear, but recent developments, such as the single-break cross-jet explosion pot and the de-ion grid should make matters easier. A saving can often be made by reducing the number of breakers, and recent developments in heavy duty fuses often make these a practicable alternative.

A More Hopeful Outlook

WHAT is the outlook for the electrical industry as we enter the new year? If we may judge from recent business events and from the opinions expressed by authorities in different branches of industry there is more justification for optimism than there was a year ago. Hopes and opinions are less helpful than are definite signs and actual facts. What, then, have we to go upon in calmly judging the situation? The fact that we have many hundreds of thousands of our people in employment who were out of work a year ago, and who now have a renewed spending capacity, should in itself, if it continues, promote still greater employment. This, in turn, will help the electrical and allied trades; but we may prefer to watch the developments more immediately affecting our own special departments—that is, contracts that have been lately placed, or may reasonably be expected to be received during the next few months, increasing the production demand on works within a short time.

Railway and Other Orders

BRITISH manufacturers of electrical machinery and equipment have recently booked substantial orders from Continental countries for railway electrification; the large commitments of the Southern Railway Company will shortly occupy manufacturers in the same class; other railways may reach a decision to undertake definite schemes before many months are past. Overseas railway possibilities may also be regarded hopefully. We have recently recorded the adoption of schemes involving large contracts for switchgear and transformers and other equipment for some of our important municipal electricity supply authorities. Many other undertakings will find large outlays imperative as the year grows older. Various distribution changes now actually receiving attention and others in contemplation will promote needs for new equipment in place of old—some of it very old—as well as cables and wires and all that goes with them for overhead and underground extensions. We have reached a point where many orders may be expected for filling up gaps in the grid. The awakening of our general industries involves expenditure upon works electrification. Shipbuilding, ship-repairing and ship electrification, colliery electrification and re-electrification, are of some consequence.

Installation Prospects

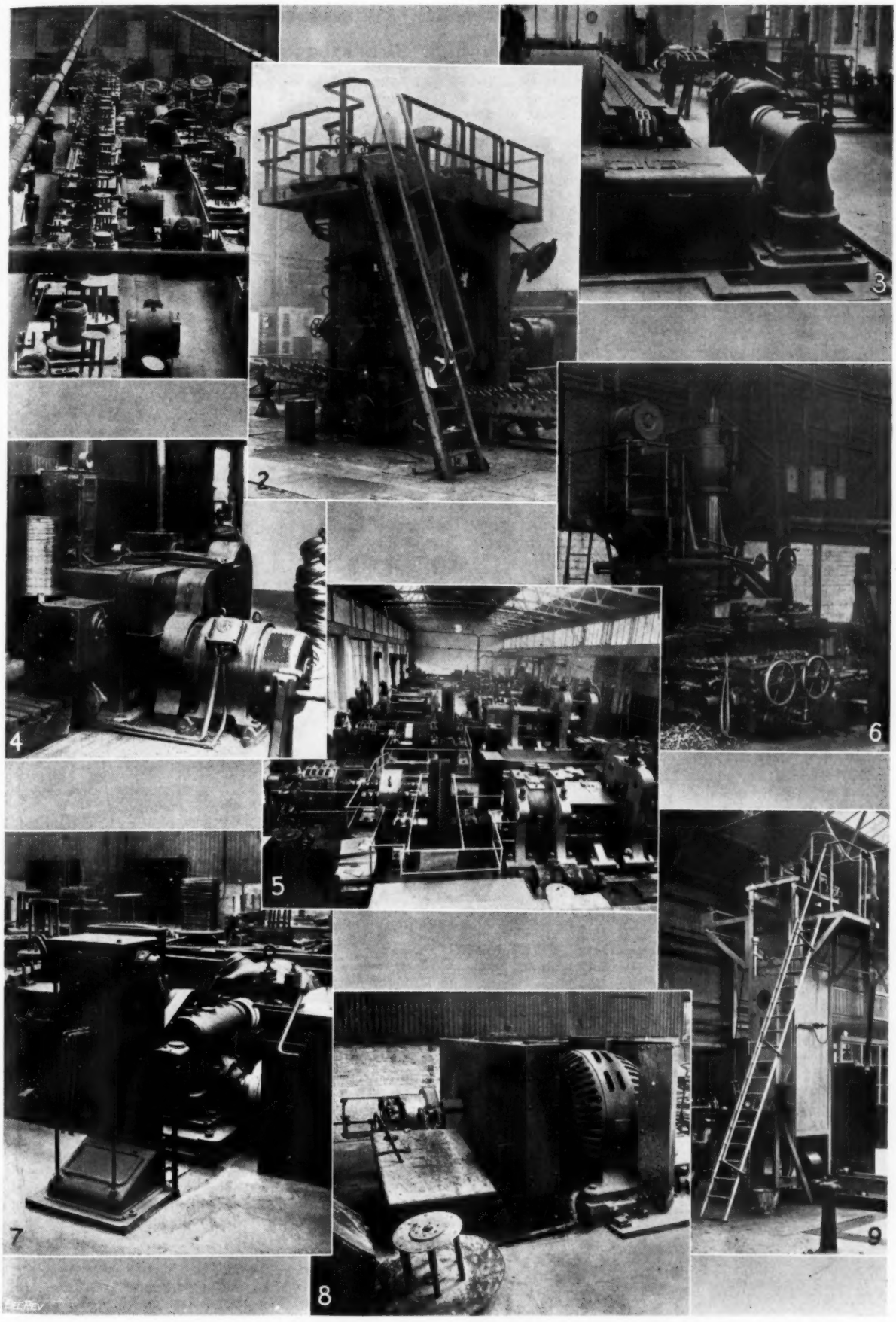
THE erection of large public buildings and hundreds of thousands of houses must stimulate electrical installation work and trade in all sorts of apparatus and materials. The increased number of already connected consumers, domestic and industrial alike, bring larger maintenance and renewal business. Our new electricity supply propaganda and expansion efforts will yield large additional trade in all kinds of lighting and general domestic appliances. The announcement that Babcock & Wilcox have booked contracts of over seven hundred thousand pounds, which will keep one of their works occupied for many months to come, is distinctly encouraging, and the presence of electrical authorities here from Pretoria in connection with plant requirements consequent upon the £6,000,000 iron and steel development there is a reminder that in the export field there has lately been a gratifying movement. 1934 should bring us much greater electrical export trade activity.

Pointers to Progress

THE practical value of a knowledge of the immediate past is the data it provides for forecasting future events. Work recently carried out or in hand by firms with such varied ranges of products as the English Electric Co., the G.E.C. and Metropolitan-Vickers (whose activities are referred to in this issue) are illuminating. The demand for more transformers of lower output and voltages is to be expected with the advance of distribution in outlying areas, and the importance attached to close voltage regulation is shown in the small sizes, down to 100 kVA, to which tap changing is applied, and the growing use of induction regulators. The attention being given to reliability is illustrated by the adaptation of impedance protection to quite short lines and by the development of a broken-line detector. Evidence of the dependence of the largest industrial consumers on the public mains is provided by the heavy winders and rolling mills supplied recently for connection to supply systems. In the M.-V. method of exploiting the rugged construction of the a.c. motor and the low moment of inertia of its rotor for rolling mills lies a pointer to future practice.

Grid Trading

THE Central Electricity Board started trading operations on Monday in the South-East England, East England, and North-West England and North Wales areas. Details of the tariffs were given in our issues of November 3rd and December 5th. Together with the Mid-East England and Central Scotland areas, in which operations on a commercial scale were started at the beginning of last year, the C.E.B. is now supplying in bulk over an area of 34,000 sq. miles, containing 65 per cent. of the population. The regions for which a grid tariff has not yet been issued are the South-West England and South Wales, North-East England, and the Central England areas.



Applications of Electricity in Metal Production. **(See next page)**

1. Cold-drawing machines for heavy wires, showing motor gangway and cable trench. 2. A three-high mill for heavy sheets and light plates up to 4 ft. wide and 11 ft. long. 3. Heavy cold-draw bench. 4. Tandem wire bench in light-wire mill. 5. Heavy cold-rolling mills in sheet and strip section. 6. High speed vertical ingot milling machine. 7. Driving unit and control panel for heavy-wire benches. 8. Heavy cold-draw machine. 9. Vertical strip annealing furnace

Electrical Metal Production. By H. Williamson, A.M.I.E.E.

Melting and handling in a Birmingham works

ELECTRICITY is employed in all the operations necessary to convert "straight" metals into alloyed ingots and finished materials for elements, filaments, &c., at the works of Messrs. Henry Wiggin & Co., Ltd., Birmingham. Monel metal, nickel, and its alloys with copper, chromium, iron, &c., are melted, cast and converted to wires, strip, tapes, sheets and blanks, which are made in a wide range of composition and sizes, and finished to specifications defining not only dimensions but also hardness, condition of surface, and electrical and physical properties. Loadings range from the delicate output of a thermo-couple to an input of 4,000 A per phase for the largest Heroult furnace.

[*H. J. Whitlock & Sons*

Mr. H. Williamson is chief engineer to Messrs. Henry Wiggin & Co., Ltd.

The component metals as delivered to the works must conform to the rigid specifications of "commercial" purity demanded by the company, and since the virgin metals are susceptible to contamination melting must be done cleanly and without risk of contact with products of combustion. For this purpose there are three Heroult arc furnaces and one high-frequency furnace. The Heroult furnace loadings range from 450 kVA to 750 kVA, the weights of the charges varying from 12 to 30 cwt. The graphite electrodes are hand controlled, and the current consumptions approximate to those of steel furnaces of equivalent capacities.

The consumption for each heat is registered, and automatic recorders provide the period and electrical history of each charge. Since the Birmingham Electric Supply Department offers a special tariff relating to furnace loads, power and furnace components have separate circuits, each of which is metered at the incoming point from the mains. The total rated capacity of these furnaces is about 3,000 kVA, and part of the load they impose on the distribution system is characterised by precipitous peaks during the melting period, followed by a steady demand during the conditioning of the bath of molten metal. The full difficulties of this load are experienced when two arc furnaces begin their "melts" at the same time; then, superposed peaks give the system some hearty "kicks," which set up severe mechanical stresses in specially protected transformers and bus-bars.

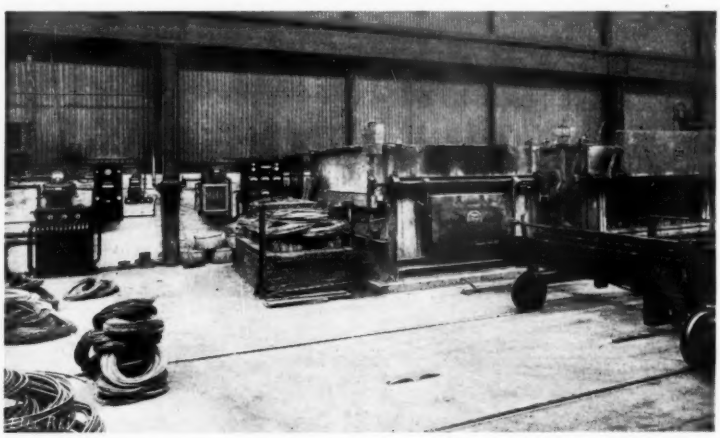
Power Factor Correction

Even in the arc furnaces, though products of combustion are absent, care must be taken lest these "pedigree" metals pick up carbon from the graphite electrodes, should these inadvertently be allowed to dip into the melt. Super alloys are melted in the high-frequency furnace, in which currents induced in the charge itself eventually bring it to the molten state and eddy currents set up in the molten metal result in a thorough mixing of the constituents. The current for this furnace is provided by a motor-alternator set comprising a 225-h.p. three-phase induction motor, directly coupled to a single-phase, high-frequency alternator. This load is quite lenient to the distribution system, there being no peaks, and protection is simple.

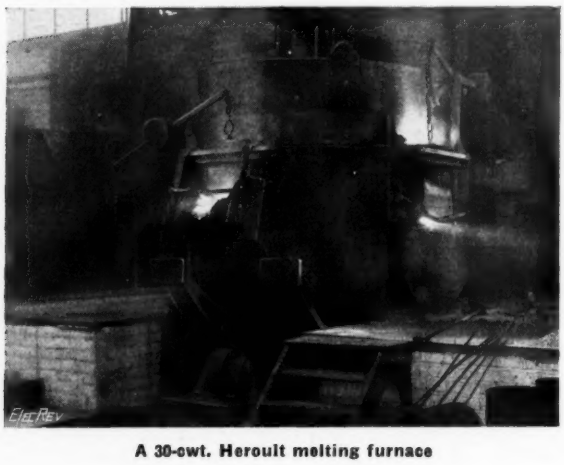
The power factor of the high-frequency section of the system is naturally low, and banks of condensers are provided for its correction; some of the condensers are permanently in circuit, whilst others can be switched in or out according to the requirements of the charge, the capacity of which varies as melting proceeds. The motor-alternator set runs at 1,500 r.p.m. and has been in service for four or five years, which speaks well for the standard that has been attained.

In the research laboratory there is also a high-frequency furnace for melting small "heats" for experimental purposes. This 15-kW unit works on the Poulsen arc principle with a frequency of between 20,000 and 30,000 cycles per second. Casting temperatures of the special alloys are of first importance. They are high and must be controlled, no products of combustion are permissible, and no source of heat other than electricity can meet the exacting requirements.

In the subsequent operations of casting, machining, fettling, rolling, and other processes, some 6,000 h.p. of driving motors is installed throughout an area of about eight acres. Large power-consuming operations are represented by hot and cold rolling for producing rounds, sheets and strips in a wide range of sizes; drawing wires of all sizes, in some cases as small as 0.0015-in. diameter; and sawing, planing, milling, turning, grinding, and drilling, in all of which the special properties of the metals and alloys present problems relating to the material and form of tools. The auxiliary motors serving the live rolls, screw-down gear, &c., of the large universal and sheet mills inflict "kicks" on the system exceeding the loads due to the main driving motors.



An electric annealing furnace for heavy wire in coils



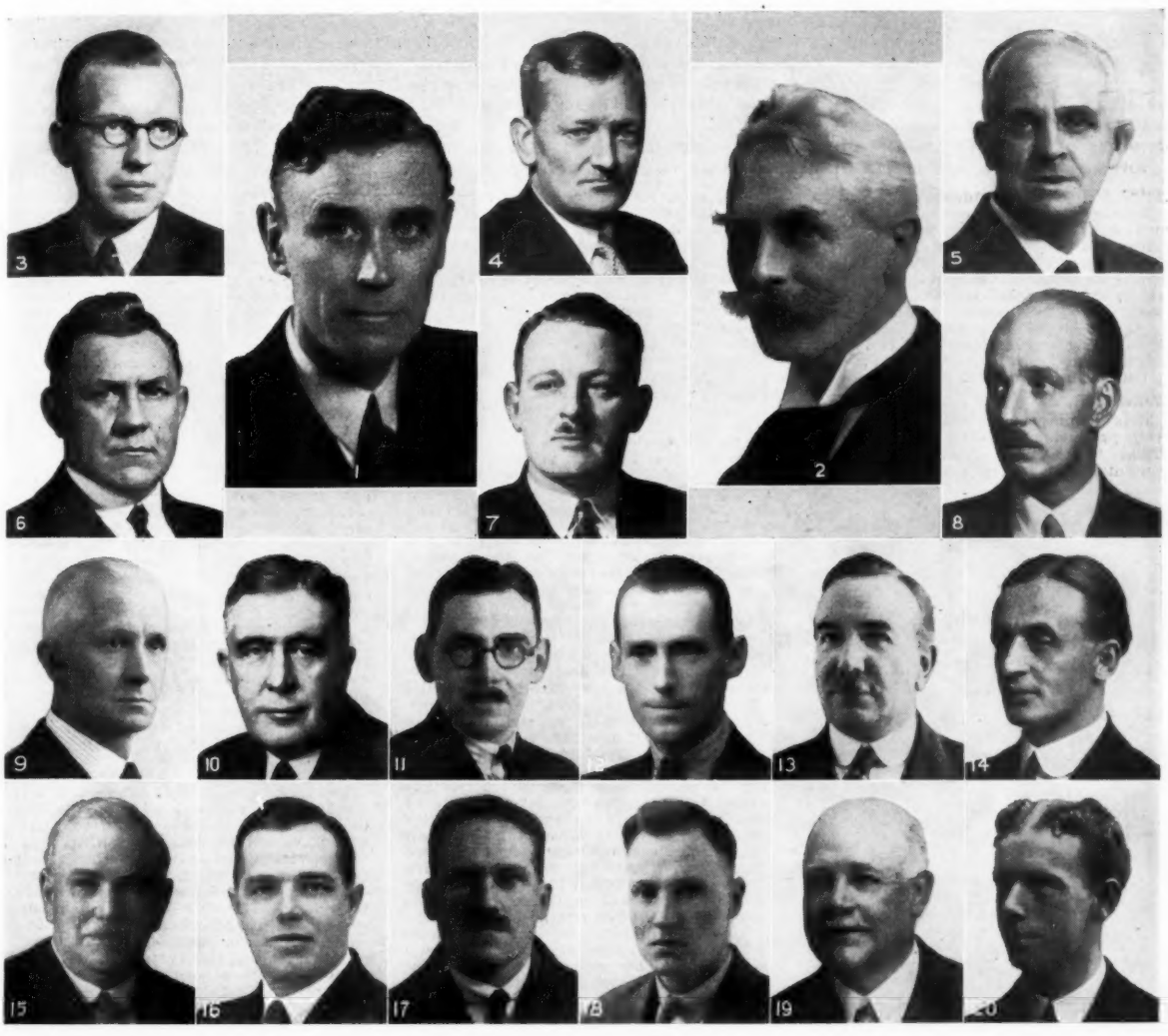
A 30-cwt. Heroult melting furnace

During reduction from the cast ingot to the finished wire, strip, tape or sheet, each alloy undergoes annealing at intermediate stages, and of the large number of different alloys each must have its own particular application of heat at each appropriate stage. Annealing that is to be followed by another operation generally demands close temperature control, and scale which forms at the annealing temperature is removed by pickling, the mechanical operation which follows restoring the surface condition of the material.

Finishing Processes

Frequently, however, the final operation is devised to impart a high surface finish. For instance, thin strip is passed between rolls polished to a mirror surface which is imparted to the reduced strip. After rolling, however, the strip is frequently too hard for the customers' requirements, and it must be softened by annealing, which has to be done without discolouring or affecting in any way the highly polished surface. Such "bright annealing" is possible only in an electric resistance furnace with a controlled atmosphere. There are a number of such furnaces, with loadings ranging from 5 kW to

Some Driving Forces in the Industry : Marryat and Scott, Ltd.



1. Mr. M. D. Scott (*Int. Rotogravure*), managing director. 2. Mr. H. Marryat, director. 3. Mr. L. H. Honey, export manager. 4. Mr. R. Walker, secretary. 5. Mr. E. C. Smith, manager, Repairs Section. 6. Mr. A. J. Wilmington, erection supervisor. 7. Mr. L. J. G. Gooch, sales manager. 8. Mr. J. E. Murrell, chief draughtsman. Representatives: 9. Mr. R. T. Marris, N.W. England. 10. Mr. R. G. Harvey, Scotland. 11. Mr. A. C. Sheldon, Midlands. 12. Mr. C. Woodhead, Yorkshire. 13. Mr. R. C. Harris, N.E. England. 14. Mr. A. G. Bruty (*Lafayette*), Ireland. 15. Mr. H. Beney, South-Eastern. 16. Mr. A. Taylor, S.E. Midland Counties. 17. Major E. A. Pells, Home Counties. 18. Mr. R. Ashley, Mid. Southern Counties. 19. Mr. J. G. Ellis, Wales. 20. Mr. H. E. Crammond, N.E. Midland Counties. (*Photographs Nos. 2 to 8 by Elliott & Fry.*)

Electrical Metal Production *(continued from previous page)*

150 kW, each designed for a particular form of material and each equipped with automatic temperature control and variable-speed mechanism for regulating the rate of passage of different sizes of wire, strip, &c., through the furnace. These furnaces were made by Birmingham Electric Furnaces, Ltd., another subsidiary of the Mond Nickel Co., Ltd.

An outstanding feature of some of the special alloys, particularly the nickel-chromium series, is their great strength at high temperatures. It is evident that materials possessing high "creep" stresses at high temperatures must be difficult to work, and in order to withstand the shocks and peaks due to this factor rolling mills, shears, and auxiliary machines must be particularly rigid in construction and powerful motors are required to drive them. Further, the metals must be worked carefully, and they cannot be raced through on mass production lines; consequently there are considerable idle running periods, so that load and power factors are inherently low, whilst the peaks are steep and high.

To this combination of "peaky" demand and low overall load factor on the power system is added the effect of the precipitous peaks inherent to the melting period of the arc furnaces, and the sudden demand from a number of thermostatically controlled resistance furnaces. Since the switching-in of these furnaces occurs at irregular intervals, moments must arrive when the demands synchronise and the total load of all the furnaces is thrown on the system.

Complete individual records are kept of the electrical consumption and periods on load of the larger units, and also of the departments in which there are a number of small "consumers." Valuable data are thus available for costing purposes and for directing attention to sections of the system in which the undesirable peaks show signs of becoming aggravated. Technique in the production of the special alloys is constantly being revised, and the ingenuity of the "process staff" in devising awkward electrical loads is a constant source of wonder to the engineers.

Special attention has been paid to the lighting of the works, for which there is provision for 500 kW, and in many departments it is practically shadowless. Electricity is also used for such miscellaneous purposes as lead melting, electrolytic coating, analysis by electrolysis, routine testing for electrical properties of finished materials, magnetic operation of clutches on mill screw-down gears, and the complete electrical operation of nearly every function of the large universal and sheet mills, all of which have push-button controls grouped at two centres. Electric welding is used for tacking together the ends of coils of wire and strip so that they may be run through machines and furnaces in continuous lengths, and also for fabricating special plant and repairs.

The "domestic" requirements of the establishment are met by electric cooking, water heating, refrigeration and tubular and radiant heating. So, the widely varying and exacting demands of this important factory, with an installed capacity of about 6,000 kVA, are met by electricity with a certainty and efficiency impossible to attain by the utilisation of any other form of energy.

The Physical Society's Exhibition

The year's achievements and development of the art of instrument making

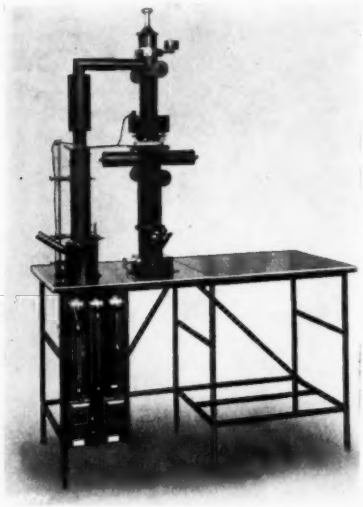
THE principal novelty of the twenty-fourth annual exhibition of the Physical Society, which is to be held next week (January 9th to 11th) at the Imperial College of Science and Technology, will be the numerous and varied uses to which the photo-electric cell and the cathode-ray tube have been put in recent months. Discourses are to be delivered on Tuesday by Mr. R. S. Whipple, who will describe the evolution of the galvanometer; on Wednesday by Mr. J. Guild, who will deal with the instrumental side of colorimetry; and on Thursday by Sir J. Ambrose Fleming, who will speak of the history and development of the thermionic valve. Of the eighty-one exhibitors in the trade section of the show, only thirty, including several publishers, are not electrical manufacturers. In the following pages we briefly review the electrical exhibits.

Baird & Tatlock (London), Ltd.

Among laboratory equipment is an automatic electric still fitted with a safety device which ejects the plug connector should the water supply fail for any reason. A transportable centrifuge, which is totally free from vibration, has been made for hospital research work. It is driven by a 10,000-r.p.m. vertical motor, and is slung by chains from a tubular stand mounted on wheels so that it can be moved about readily.

Bakelite, Ltd.

This display will comprise synthetic resin products, moulding materials, electrical insulating varnishes, liquid cements, glass lamp and valve sealing



Cambridge high-speed cathode-ray oscillograph

cement, plastics for filling cavities, lacquers, laminated sheets, tubes, and rods for insulating and decorative uses.

British Electric Resistance Co., Ltd.

Among this company's exhibits will be radio potentiometers, rheostats with self-lubricating brushes, adjustable resistances, including a laboratory type with an automatic cut-out to protect windings against excessive overload; and vitreous enamelled units embedded wire type, non-hygroscopic porcelain tubes, with connections for from 0.1 to 100,000 ohms.

Cambridge Instrument Co., Ltd.

The illuminated moving scale indicator recently introduced for industrial use as an indicator of temperature or CO_2 percentage of flue gases has also been found suitable for use as an electrical fluxmeter. The freedom from parallax error and the clear readings make this form of instrument particularly convenient for mass testing and routine work in factories, and, since the highly magnified scale is readable from a considerable distance, it is useful for lecture work.

In conjunction with this fluxmeter there is a search coil designed for use on moving-coil loud-speaker magnets. It consists of a copper coil wound on a celluloid former, and having a mean diameter equal to that of the gap of the permanent magnet. The coil is fitted in a special holder so that it may be moved through a definite distance in the gap in a direction perpendicular to the lines of flux.

In the high-speed cathode-ray oscillograph the cold-cathode is maintained at a potential of 10-70 kV negative with regard to the anode. The deflection chamber may be removed easily and an electron diffraction chamber substituted for crystal analysis. A lead-lined fluorescent shutter enables the oscillogram to be viewed before exposure, and the instrument can provide distortionless records of transient phenomena with a duration of less than a hundredth part of one micro-second.

A form-factor meter designed by Mr. R. S. J. Spilsbury, of the National Physical Laboratory, comprises a dynamometer voltmeter connected in parallel with a copper-oxide rectifier voltmeter. The dynamometer is calibrated with a single point on the scale, and sets the voltage across the combination to a predetermined r.m.s. value. The readings of the rectifier instrument are proportional to the mean or average value of the voltage, and the scale is directly calibrated in the ratio between the mean and r.m.s. values, which is the form factor. A three-dial series resistance allows the instrument to be used on any voltage between 5 and 100, and it is accurate to 0.01 per cent.

The Campbell magnet inductor forms a convenient and accurate magnetic standard. The use of a special steel having extremely stable magnetic characteristics has rendered it possible to employ a permanent magnet as the primary. A coil is rotated in the field of the magnet, cutting the lines of force, and causing a current, which is proportional to the flux, to flow in the coil circuit. A switch enables five different fractions of the total turns in the coil to be put in circuit, giving total line turns of from 30,000 to 600,000.

Cardine Accessories, Ltd.

The company's equipoise lamp has a new system of suspension by means of springs which give the lamp extraordinary mobility. A light touch will direct the beam of light to the spot required, where it remains poised. The system is applicable to standard, wall-bracket, and ceiling lamps, and can be made to carry any weight.

R. M. Catterson-Smith.

An electrically heated "glory hole" for glass blowing, resistance furnaces for laboratory use, with refractory and insulating materials will form this exhibit.

Crompton Parkinson, Ltd.

One of the new types of multi-range portable "Tong-Test" ammeters for one-hand operation on both d.c. and a.c. is available to take conductors up to 4in. diameter and another for use in link distribution boxes, this type being provided with a hinged mirror to reflect the scale on the periscope principle for convenience when used below pavement level. The original type "A" can now be supplied with mumetal "tongs" and m.i. ammeter for readings below 50 A when first-grade accuracy is required on d.c., or when the instrument is intended primarily for magnetic demonstrations.

A hand-operated power factor demonstrator is a new production on original lines. It may be set to demonstrate the power and wattless component of a circuit at any power factor desired.

Moving-coil double pivot indicating instruments with special pole pieces giving uneven scale divisions for the use of the physicist enable currents down to half a microampere to be clearly indicated. The instruments have resistances varying from 2 to 2,000 ohms. A simple and inexpensive transmitter and indicator of the ratiometer type is specially suitable for remote indication of any quantities when adequate power is available for operation of the transmitter.

Additions have been made to the range of thermal maximum demand indicators with time periods of 15, 20, or 30 minutes.

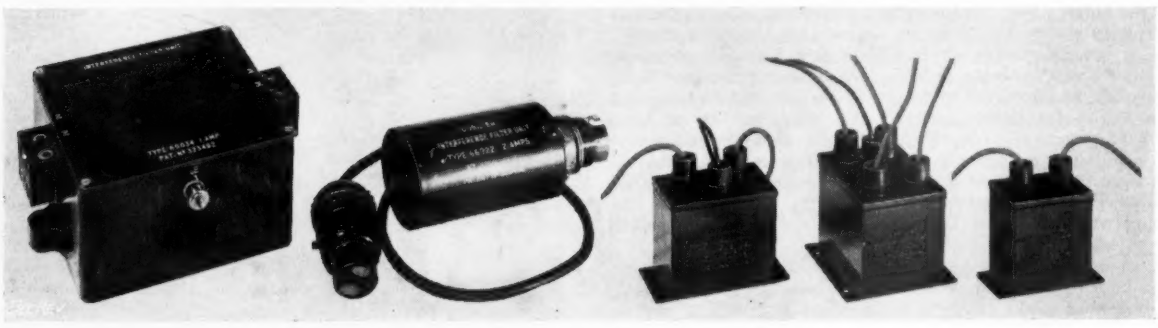
Drayton Regulator & Instrument Co.

Two different systems of electric tele-transmission of mechanical instrument movement are suitable for remote indicating, recording, and integrating.

The variable-potential system is independent of voltage and periodicity variation, but requires adjustment for line resistance. The split-potential balancing system is, in addition, independent of line resistance, and the balance is effected by a specially wound watt-hour meter movement which has sufficient power to actuate pointers up to 40in. long over a 270 deg. scale. The primary impulse can be taken from any pressure, temperature, liquid level, or flow indicating or recording instrument, or may be direct mechanical movement.

The proportional electric regulating system is also based on the split-potential resistance balancing principle. The variation of the brush position on the resistance connected to the impulse device unbalances the torque of two coils on an iron armature which actuates a contact arm, which makes one of two contacts on being deflected in one direction or the other, thereby starting the operating motor either direct or through relays according to size of motor. On balance being re-established, the armature returns and the motor stops.

A new room type thermostatic switch, for capacities up to 30 A, is a highly sensitive diaphragm-capsule-operated, snap acting, thermostat in combination with a compact vertical mercury switch relay. Considerable power is available; a temperature variation of as little as ½ deg. F. is sufficient to overcome the force of a holding magnet to give a snap break.



Dubilier interference filter units of various patterns

Dubilier Condenser Co. (1925), Ltd.

The advantages of using various types of radio anti-interference devices are to be demonstrated. Electrolytic condensers in impregnated cardboard containers are manufactured in single units and multiple capacities made up in block form. There is a reversible type specially designed for use in a.c. and d.c. radio receivers, which is now obtainable for operation up to 275 V d.c. Electrolytic condensers in cylindrical aluminium containers cover a wide range, while the main feature of paper condensers is a new non-inductive type 9,200, which is now available in cylindrical aluminium containers incorporating special means of fixing to the chassis of a radio receiving set.

Metallised resistances of from ½ to 3 W, small moulded mica condensers, laboratory standards, and transmitting types will also be on view.

Ebonestos Insulators, Ltd.

These moulders to the trade have selected examples of mouldings made of bakelite and other synthetic substances, as well as various "Ebonestos" compositions, which have been made up for different firms which manufacture electrical and other types of scientific instruments.

Edison Swan Electric Co., Ltd.

Besides "Pointolite" and mercury-vapour "Escura" lamps, there are cathode-ray tubes with new fluorescent screens for television, to produce high-intensity images with accelerator voltages up to 2,000 V; oscillograph equipment for a.c. operation, or for use with the new small size 300-V batteries specially made for the purpose; and special mercury-vapour hot-cathode discharge valves for use with cathode-ray tubes.

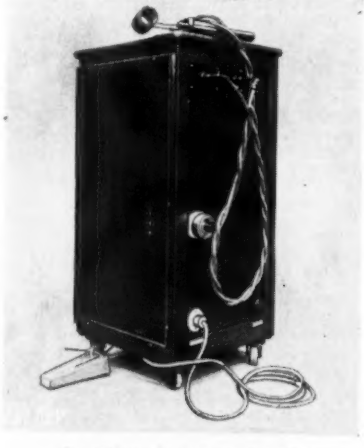
Among rectifiers are the high-vacuum 200-kV peak type; hot-cathode oxide-coated bi- and three-phase types for voltages up to 250 V and outputs up to 50 A; large mercury-vapour types with the new separately heated barium-activated cathode for outputs up to 100 kW with mean d.c. up to 25 A at 15,000 V; and a grid-controlled mercury-vapour rectifier for d.c. outputs up to 25 A.

Radio valves include the new low-temperature anode class for outputs up to 60 W, the screen-grid short-wave type for dissipating up to 250 W, and large short-wave oscillators up to 20 megacycles with new low-temperature radiation-cooled anodes for dissipating 2 kW. Hydrogen-filled iron wire barretters, high vacuum thermal relays, and hydrogen-filled heat-resisting mercury-in-quartz switches complete the exhibit.

W. Edwards & Co.

This exhibit of vacuum pumps of many different types includes some specially suitable for neon tube making, and there is a new type of ageing transformer for luminous tube signs with variable on-load output.

A high-frequency generator is suitable



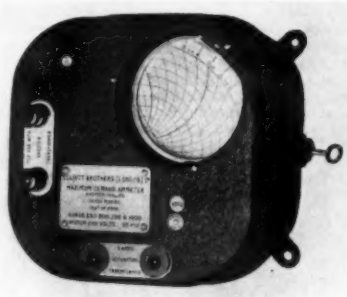
An Edwards h.f. generator

for eddy current heating of radio valves, neon sign electrodes and laboratory purposes, such as degassing of metals. The tungsten spark-gaps are of particularly robust construction. A portable discharge tube, complete with transformer, is used as a light source for spectroscopic and stroboscopic work, &c. Other items are a rotary blower and vacuum pump with automatic "cut-out," hand torches and bench burners.

Elliott Brothers (London), Ltd.

Besides miniature moving-coil a.c. instruments with self-contained thermo-couples and metal rectifiers, and 2-in. dial round and edgewise d.c. types, there is a very small current transformer in a moulded insulation case for use with a miniature moving-iron ammeter.

The maximum-demand recording ammeters (Shotter patent) of the d.c. moving-coil type, rectifier operated, give full-scale deflection for 40 mA on a.c. The disc chart is driven by a self-con-



The Shotter-Phillips maximum demand ammeter (Elliott Bros.)

tained synchronous clock motor and makes one revolution in seven days. An inkless record is made every 15 min., and the resultant chart gives the current variations throughout each 24 hours for a week. By leaving the instrument in circuit for longer periods the daily records are superimposed over one another, and the average demand at any instant can be ascertained for any period.

A programme transmitter in conjunction with an automatic regulator enables a definite and predetermined programme of operation to be followed; for example, when it is required that the temperature of a furnace shall first rise, then remain constant for a definite period, and finally drop again at the end of the process. The transmitter incorporates a number of cams which are cut in accordance with the required programmes and driven by a clock or an a.c. synchronous clock motor. The operation of the cam causes a "ring tube" resistance to be varied, applying a back e.m.f. to the automatic regulator, complementary to the e.m.f. which is being measured; the sum of the two is kept constant corresponding to the position on the indicating scale at which the control is set.

The Siemens cross filament optical pyrometer is a new type which is direct reading and completely self contained in a small case. The lamp has two filaments crossing each other, a ribbon and a wire flattened at the place of conjunction, composed of two materials which have diverse temperature-current characteristics. The two filaments are equally brilliant at one temperature only, and this temperature is quickly and easily obtained by adjusting the resistance until the two filaments merge.

The Tollemache bin level indicator, which is claimed to be the only one of its kind, has been primarily designed for use with pulverised fuel, but can be satisfactorily operated with practically any powdered or granular substance. The pressure, or withdrawal of the pressure, caused by the substance in the bin operates a diaphragm which is spring-loaded and attached to a plunger, opening or closing a set of contacts.

Everett, Edgcumbe & Co., Ltd.

The company has added to its cube integrating photometers the "Lumen Cube," direct-reading photo-electric indicator. This enables the luminous output, the watt consumption, and the efficiency of the lamp in lumens per watt to be at once determined.

Among the many uses of the "Synclock" (Warren) motor is that of the process timer which is so arranged that it will start operating as soon as the main switch controlling the process is closed, and at the expiration of the preset time interval will make contact, which may either give an audible or visible warning or stop the process.

The rectifier-operated voltmeter has not hitherto been available for much lower than ½ V, except in the case of laboratory instruments of extreme delicacy or by the use of a transformer, which necessarily consumes a considerable amount of power. Messrs. Everett, Edgcumbe, have designed robust a.c. millivoltmeters and micro-ammeters of very small power consumption. The instrument actually shown has ranges of 0-200 mV, and 0-50 micro-amperes respectively. The millivoltmeter takes less than 0.1 mA, and the micro-ammeter has a voltage drop of less than ½ V.

For the rapid testing of condensers a direct-reading capacity meter has been introduced which consists of a milliammeter for connection to a 50-cycle supply, in series with the condenser to be tested. If the voltage is normal, the scale is direct reading in microfarads, but since the supply voltage may be either above or below its normal value at the time of test a standardising circuit is provided in the instrument.

Commutator brush wear and indifferent contact are avoided in the latest magneto-electric speed indicators by the substitution of an a.c. generator in which all the windings are fixed and only a cobalt steel permanent magnet rotates. By the use of a rectifier-operated moving-coil indicator scaled in r.p.m., the advantage of a perfectly evenly divided scale throughout the range is obtained. A compact inkless grapher, measuring only 9 in. × 6¼ in. × 4¾in. is suitable for use in street pillars and in other situations where the ordinary grapher is too large, and is available as a voltmeter, ammeter, or wattmeter.

In the event of a defect in the insulation, the metal work of a rubber-tyred trolley-bus may be at a considerable voltage above earth. The Ministry of Transport regulations direct that the insula-

The "Lumen Cube" photometer (Everett, Edgcumbe)

tion is to be tested at frequent intervals and under normal working conditions. A portable leakage indicator has been designed for this purpose.

Evershed & Vignoles, Ltd.

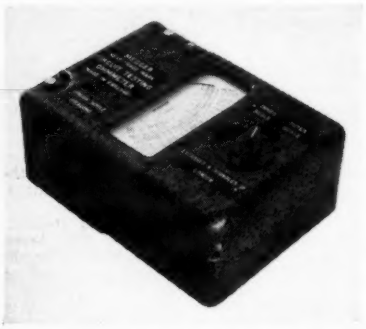
A "Megger" capacity meter is the first of its kind. It includes a moving-coil instrument and an a.c. hand generator. The readings obtained are independent of variations in voltage and frequency, and low ohmic resistance in parallel with the capacity under test does not affect the accuracy of the reading. A workshop type is for use with a.c. mains supply in place of the self-contained generator.

A new recording "Megger" insulation tester is especially useful for making tests of armatures, field coils, transformers, &c., during the process of drying out. Owing to the very small current used when measuring insulation, a "tapping" type of recording mechanism is employed to eliminate friction.

A development of the "Wee-Megger" tester is designed for tracing circuits and the measurement of any conductor resistance. It is unaffected by variations in voltage, and in place of the usual generator a standard flat type 4½-V dry battery is provided. There are two distinct types for low and high resistances respectively, covering between them the measurement of resistances of a few ohms up to 200,000 ohms.

Leakage indicators and recorders have always been liable to damage through the

high current passing through the earthed neutral when a breakdown occurs. In the Knowles-Shotter instrument use has been made of mumetal. The moving-coil rectifier-operated type is connected to a transformer and to a reactor so constructed that the transformer core becomes saturated when the leakage current reaches 10 A; any increase in this current has practically no effect on the secondary current and therefore no harm can come to the instrument.



The Evershed "Megger" circuit tester

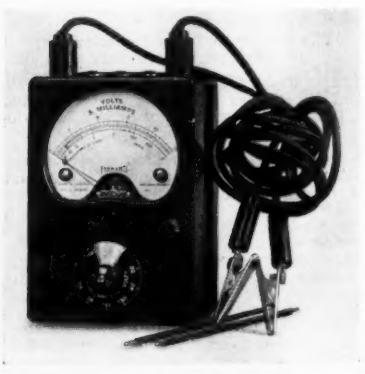
Ferranti, Ltd.

A new 0-150-V electrostatic voltmeter has a scale reading in 5-V divisions from 20 V upwards, and is of good scale shape from 30 to 150 V. Magnetic damping is provided, and the capacitance at full scale is 100 micro-micro-farads. It is spring-borne in a substantial cast-iron case. The company's 0-12-kV electrostatic voltmeter operates in conjunction with a fixed condenser, used as a potentiometer, fitted in the same wooden case.

Various combinations of 2½-in. instruments make compact self-contained multi-range testing sets, prominent amongst which is one that measures from 0-1 to 0-750 mA and from 0.3 to 0-600 V d.c., from 0-15 to 0-600 V a.c., and from 0 to 50,000 ohms, with a resistance of 1,000 ohms per V, which means a full-scale consumption of only one mA.

The universal valve tester is a first-grade instrument with a resistance of 1,000 ohms per volt, and is supplied with three adaptors to make it suitable for all valves. The radio service tester is capable of taking the majority of measurements necessary in checking and testing radio receivers.

The triple-pole relay shown has the two outer poles arranged for over-current protection and the centre pole for earth leakage protection. It is of the induction pattern, spring controlled, with inverse and definite minimum time lag. Outstanding features are excellent torque, low volt-ampere operation, and exceptionally effective damping magnets which prevent overswing. This relay is available in single, double, and triple pole types.



The Ferranti a.c./d.c. testing set

A compact auxiliary relay which is free from noise and consumes little power operates with a good safety factor on 0.3 VA when wound for any voltage below 40. Above this the consumption is 8 mA. irrespective of the voltage. Its contacts will deal with 5 A a.c. on circuits up to 400 V. A control relay that has a wide range of applications is controlled by four mercury switches, which may be arranged either to open or close circuit. collectively or in any combination.

An a.c. reverse relay with time lag is compensated for fall in voltage so as not to increase the current required for operation which will remain correct should the voltage fall to 1 per cent. of full voltage.

Foster Instrument Co., Ltd.

A comprehensive range of electrical pyrometers and automatic temperature controllers of the indicating and recording types includes a new alarm recorder of the circular chart type with an adjustable contact for operating a signal lamp or bell when the set temperature is exceeded. The instrument is simple and ingenious, there being very few parts.

Primarily designed as a pyrometer indicator, particularly for use in steelworks, the projected scale indicator can be supplied as a millivoltmeter. By means of an optical system, a small section of a scale mounted on the coil of a sensitive galvanometer is greatly enlarged and projected on to a glass screen in the front of the instrument, accurate readings being possible from a considerable distance and under practically any conditions of light.

A. Gallenkamp & Co., Ltd.

Electric ovens for drying, baking, etc., with automatic thermostatic control to ±1 deg. C. over a full working range of 37 to 100 deg. or 50 to 300 deg. are now made with a matt aluminium finish.

Furnaces of the universal, crucible, &c., types are provided with wire-wound heating elements for thermostatically controlled temperatures up to 1,000 deg. C. "Silit" elements are fitted for temperatures up to 1,350 deg. C. in muffle furnaces, and up to 1,400 deg. C. in the tube pattern. Davies' improved plug-key resistance boxes, galvanometer shunts, &c., are made with totally enclosed contacts to exclude dust and prevent surface leakage, so maintaining constant resistance over long periods.

A new British-made single-stage rotary oil-sealed vacuum pump is suitable for backing or rough evacuation, and is silent in operation. Ambler's gas analysis outfit, which is specially intended for routine works use, is accurate to 0.5 per cent., while the precision model has an accuracy within 0.1 per cent.

Gambrell Bros. & Co., Ltd.

A range of portable testing instruments, radio-frequency instruments, condensers, d.c. equipment, galvanometers, potentiometers, Wheatstone bridges, resistance boxes, &c., will be shown by the company.

Griffin & Tatlock, Ltd.

Laboratory instruments and apparatus include a Bateman magnetic balance from which the effect of the outer poles is eliminated in a simple way. There is also an inexpensive oscillograph based on moving-coil loud-speaker design, which accurately reproduces both sound and a.c. wave-form. Galvanometers, valve oscillators, high-voltage generators, and accessories are other items.

Henry Hughes & Son, Ltd.

Magneto-striction echo sounding gear indicates the depth of water below any vessel by measuring the time taken for an impulse to travel from the vessel to the bottom of the water and back again. A short train of impulses is sent by a magneto-strictive oscillator, and the echo is received by a similar oscillator which is actuated by the echo train to give a short burst of alternating current, the magneto-strictive effect being reversible. This incoming signal is amplified and used to discharge a condenser through a revolving coil system controlling the position of a long pointer that gives a steady indication of the depth on an open scale. A recorder for launches has two ranges from 0-125 and 100-225 ft., the depths being recorded on a scale of about 1/32 in. to a foot. The charts show a variation of depth of less than 6 in.

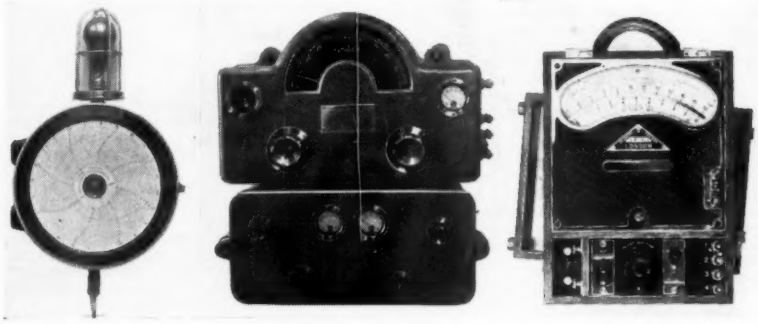
For ships the chart of soundings can be made as large as can be conveniently used and is not restricted by the total depth to be recorded.

Igranic Electric Co., Ltd.

An eddy-current motor-driven timing relay for automatic control of reversing operations is adjustable by a variable resistance, and any desired contact arrangement or time lag can be provided. The Type No. 1035B automatic star-delta starter has a thermal timer strip directly heated by the current induced in the secondary winding by one of the contactor coils.

An induction-type phase failure and phase reversal relay is employed where the effects of single-phasing, or accidental reversal of the driving motor, due to reversal of the supply, must be prevented. A syphon-operated pressure switch is specially designed for small compressors and refrigerators where direct control of comparatively small motors is required within narrow limits of pressure, while a vacuum-operated starting switch can be supplied in either the double-pole or triple-pole type for direct switching of small motors in accordance with variations of vacuum.

Latched-in contactor switches designed for the automatic control of lighting or heating circuits, with operating coils energised only momentarily during switching on or switching off, of 50 and 100 A are shown. There are also ironclad drum-type master switches for the direct control of motors driving machine tools of all classes, an "Igranic-Hodac" emergency supply change-over panel which keeps the standby battery automatically charged when not in use, circuit-breakers, an automatic starter for slip-ring motors up to 200 h.p., and a reversing controller for d.c. motors in which arrangements can be incorporated for automatic slow-down and dynamic braking.



Left: The Foster temperature alarm-recorder. Centre: Magneto-striction echo sounder (H. Hughes & Son). Right: The Negretti & Zambra ventilated thermo-couple hygrometer

Isenthal & Co., Ltd.

Laboratory resistances, mercury switches, and relays are made in variety, while voltage regulators now include the "I R" type, shown for the first time. This has automatic features which enable variations of ±50 per cent. to be automatically compensated for. The sliding transformer principle is retained, but the secondary is wound with a profile ring interposed upon the primary, so that by grinding off the insulation a smooth circulation path is presented for a carbon roller capable of dealing with a continuous load of 25 A. This collector can be moved over the winding by hand or a small reversible motor, the apparatus being controlled by a sensitive mercury switch relay connected across the variable voltage. The accuracy is plus and minus 1 per cent. and the whole range of ordinary voltage variations is covered in a few seconds.

In another form the controller can be made to "buck and boost" the voltage by very considerable amounts. So far the apparatus is built in six different sizes,. from 0.5 to 7.5 kVA output, corresponding to 7 to 75 kVA loads with the usual 10 per cent. variation. The firm's glass-blowing department (mercury switches and resonance neon tubes) has

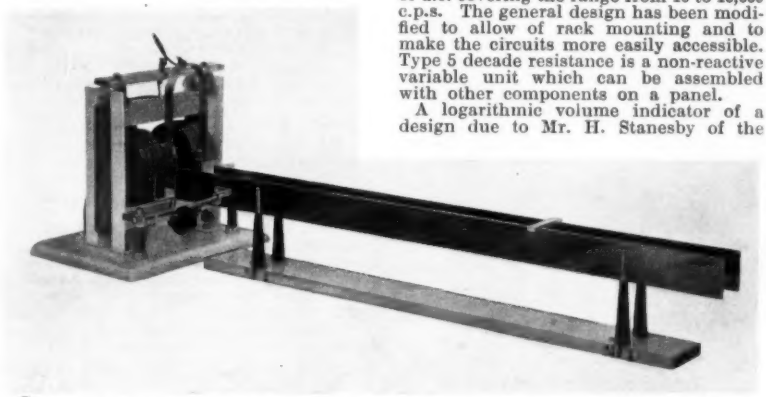
embarked upon a new venture, namely, cathode ray oscillograph tubes with suitable mains units.

Marconiphone Co., Ltd.

This company will display battery and mains-operated superheterodyne radio receivers, radio-gramophones, a new pick-up incorporating hum-neutralising coil, a full range of thermionic valves for a.c. and d.c., and rectifiers.

Marconi's Wireless Telegraph Co., Ltd.

Type MG.8A is a simple type of frequency meter covering a range of 100-3,000 kc. with an accuracy of one part in 10,000. It consists essentially of a tunable inductance capacity circuit connected to a thermionic detector and a galvanometer indicator.



Marconi 50-W magnetron h.f. generator and special circuit for medical research

A compact radio receiver of the superheterodyne type for the reception of telephony and c.w. and i.c.w. telegraph signals is particularly suitable for use under arduous service conditions. It can be arranged for either battery or all-mains working.

For demonstrating the use of high-frequency currents for medical and surgical diathermy a circuit is employed which incorporates valve rectifying equipment and a thermoammeter for indicating the h.f. output to the patient. Supplies are intended to be taken from 50-cycle a.c. mains, and the input power is approximately 1 kVA. For studying the effect of concentrated high-frequency fields on bacteria cultures and pathological specimens use is made of a split anode magnetron, consisting of a straight tungsten filament surrounded by two half-cylindrical anodes in a hard glass envelope highly evacuated. This is so arranged that oscillations are obtained whose frequency is dependent upon the natural frequency of the circuit connected to the valve.

For the Marconi-Stille reproducing equipment a magnetic record is applied to a thin flexible steel tape which is driven at a constant speed.

Mercury Switch Manufacturing Co., Ltd.

A variety of standard mercury switches with capacities of 1-80 A includes a new range in which porcelain liners are fused to the glass tube so that all arcing takes place on the porcelain. The possibility of mercury creeping under the liner and so causing a short circuit is precluded. An interesting comparison of two switches, one made of normal glass with liner, and the other of hard glass with fused-in liner, both operated 1,000,000 times at 30 A (rated capacity and voltage) shows the normal condition of the switch intact but badly burned, while the fused liner switch is entirely unaffected. In a new type of vertical switch fused porcelain is employed, on which arcing takes place. The capacity is from 10-30 A at 250 V.

Mercury switches with guaranteed low constant resistance contacts are shown, and a new type of magnetically operated switch. Other items are switches fitted with specially treated mercury for the purpose of obtaining extremely fine differential between make and break, change-over switches, &c.

Muirhead & Co., Ltd.

A 1,000-cycle frequency standard similar to those supplied to the B.B.C. for the frequency control of broadcasting stations consists of a valve-maintained tuning fork of N.P.L. design mounted in an oven and arranged on a standard 19-in. rack, together with the necessary driving circuits. The fork is temperature and pressure controlled and a thermometer and a manometer are fitted. The thermostat relay is valve operated.

The Type 11 variable air condenser is a precision instrument for use as a laboratory standard or in an accurate wavemeter. Quartz insulation is used and the rotor is turned by means of a sprung worm which is totally enclosed. Type 14 inductometer has been produced to provide a low-priced continuously variable standard of five types with maximum inductances of from 50 to 500 millihenrys.

The N.P.L. beat tone oscillator Type 3 provides a continuously variable source of a.c. covering the range from 10 to 10,000 c.p.s. The general design has been modified to allow of rack mounting and to make the circuits more easily accessible. Type 5 decade resistance is a non-reactive variable unit which can be assembled with other components on a panel.

A logarithmic volume indicator of a design due to Mr. H. Stanesby of the P.O. Radio Research Station, for monitoring and controlling audio-frequency circuits, has the scale calibrated evenly in logarithmic units by means of an anode rectifier preceded by an audio-frequency amplifier with special biasing arrangements to shape the scale in the desired way.

Nalder Bros. & Thompson, Ltd.

A complete series of miniature instruments, giving long circular scales and mounted in either projecting or flush pattern cases, known as the "Bijou" L type, are made in two sizes with 2½- and 4-in. dials. The wattmeters, reactive-kVA meters, ammeters, and voltmeters give an angular deflection of about 300 deg.; the power-factor meters and synchroscopes give a complete 360-deg. scale and the 4-in. dial frequency meter a 90-deg. scale. A portable a.c. testing set, comprising a long scale 2½-in. dial ammeter, voltmeter, wattmeter, and power factor meter, weighs only 4 lb. and measures 7 in. by 11 in. by 3 in.

The Type "N.L." relay consists of two elements in one case: an overcurrent element having an inverse time limit with adjustable definite-minimum time characteristic; and a directional element which is intantaneous in operation. In the "Nalder-Lipman" directional-overcurrent relays operation is independent of power factor and voltage, both of which may be very low during abnormal conditions; there are independent current and time settings.

A summation wattmeter calibrated in megawatts is arranged to summate the load of three independent circuits, namely, one three-phase, four-wire unbalanced load circuit, one three-phase, three-wire balanced-load circuit at 50 cycles, and one three-phase, three-wire balanced load circuit at 40 cycles. It is of the four-element type and gives a scale length of 45 in. The pointer and the figuring are of special shape, enabling accurate readings to be taken from a considerable distance. A novel form of precision deflectional-type frequency meter having a long circular scale and calibrated to read 48-50-52 cycles per second over the full scale of some 40 in., has been specially designed to facilitate maintaining a constant frequency on frequency-controlled mains and can be read to within 1/1,000th of a cycle.

Negretti & Zambra, Ltd.

A ventilated thermo-couple hygrometer gives direct indication of wet bulb depression on a very open scale by the use of a large number of pairs of thermocouples in series, so arranged that alternate junctions are grouped together, one group having all the junctions fitted with muslins, enabling them to operate as "wet bulbs." The deflection of the pointer on the "wet bulb depression" scale of the indicator is due to the difference in e.m.f. produced by the two groups of thermocouples. On a second scale of the same instrument, the dry-bulb temperature is obtained from a resistance element which is housed in the same tubular head as the thermocouples and through which the air is aspirated by means of a suction fan.

The automatic humidity controller is used in connection with a compressed air relay system in conjunction with diaphragm-motor operated valves. An impulse-type pyrometer controller has an additional mercury switch so that electrical impulses of a duration of from about 1 up to 10 sec. may be given to a motor-operated valve.

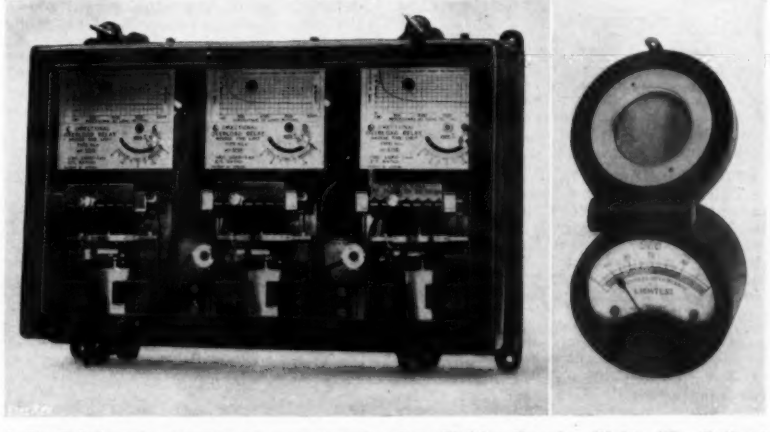
In an electrical resistance or thermocouple temperature recorder of the continuous chart type, suitable for recording the temperatures of from one to six points on one chart, a multi-coloured ribbon is used to enable easily distinguishable traces to be obtained. The instrument is fitted with a synchronous-motor drive giving exact timing and permitting the recorder to be run for fifty days without attention.

W. H. Pettifor.

A range of electrical aids for the deaf of various pitches, possessing different wave-form characteristics, includes a testing outfit that enables a prescription to be made out for an individual to give the most suitable pitch, wave-form, and volume of sound. The latest developments are a redesigned Marconi "Optophone" and a new type of bone conductor receiver which may be used with or without a non-valve amplifier.

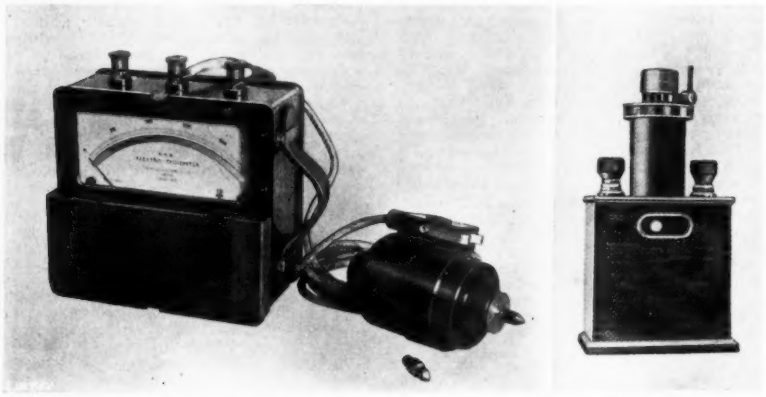
Philips Lamps, Ltd.

Self-contained "Metalix" shockproof apparatus, designed expressly for X-ray crystal analysis by the Debye-Scherrer and Seemann-Bohlin methods, incorporates considerable improvements. Since all external parts of the apparatus are earthed, there is no risk of danger from electric shock. The exposure times are considerably less than those required with earlier types of apparatus, and there is no need for continuous observation.



Left: Triple-pole directional overcurrent relay (Nalder Bros.). Right: The Salford pocket size foot-candle meter

The "Metalix" "Line" focus research tube for crystallographic work embodies complete protection against unwanted X-radiation.



Left: A Record portable tachometer. Right: The Pye automatic levelling mirror galvanometer

Besides a sodium lamp and rectifier specially designed to give a source of high intensity for methods of analysis involving the use of polarised light, a sodium lamp to operate on d.c. mains is now also available. A recent development is a water-cooled valve designed to rectify up to 125-kV peak, and to deal with 200 mA continuously. Also a new valve rectifier with voltage drop of the order of 30-50 V of heavy current-carrying capacity.

Other items are transformers, oil condensers up to 120,000 V for oscillographic, cathode-ray, and X-ray work, mercury switches, vacuum and gas-filled photo-electric cells, barreter lamps for limiting current flow, rare gas fuses, and gas-filled oxide hot-cathode relay tubes, whose operation is similar to that of rectifying tubes in so far as they pass current in one direction only. The third electrode, however, controls the rectified current within certain limits, *i.e.*, increasing the negative voltage applied to the auxiliary electrodes increases the critical anode voltage which must be applied before anode current passes, thus enabling the tube to act either as a relay or as a current controller.

W. G. Pye & Co.

Heretofore the only endeavour made to dispense with levelling screws on suspended-coil galvanometers has been the use of taut suspension, which gives too much torsional control to allow sensitivity with appreciable advantage over the pointer-type instrument. A new automatic levelling mirror galvanometer is, however, now available which has a magnet suspended on gimbals and so balanced that it will always hang in the same alignment as the coil.

The inconsistency of thermionic valves has prevented them being fully developed for the measurement of very small potentials and currents. A compensated circuit evolved by Dr. A. S. McFarlane enables full advantage to be taken of the valve potentiometer by permitting adjustment of the grid impedance without introducing consequential errors, so obtaining the essential condition of zero grid current flow.

Record Electrical Co., Ltd.

This series of insulation and resistance testing sets, including the "Minor," with constant pressure generators, gives ranges from 0-20 megohms at 100 V up to 0-2,000 megohms at 1,000 V. A recent addition is the a.c. work-bench ohmmeter for measuring resistances from the lowest up to and including 2,000 megohms at testing voltages of 250, 500 or 1,000.

Switchboard and portable ammeters and voltmeters include "Cirscale" instruments, which have clear open scales extending over an arc of approximately 300 deg., this deflection being obtained entirely without gearing. A complete range of electric tachometers is made in five different patterns. A portable pattern has recently been put on the market for testing the speed of revolving parts or checking the accuracy of existing tachometers of all types. Several ranges can be supplied on the one instrument. A cheaper pattern has also been designed, consisting of a small alternator used in conjunction with a moving-iron-type indicator, or, alternatively, a moving-coil "Cirscale" indicator having a metal rectifier. This equipment can be supplied in the fixed or portable type, and is serviceable for use on locomotives, motor buses, or cars, the indicator being calibrated to read in m.p.h.

The Research Section

In this section the following will exhibit and demonstrate apparatus: Mr. R. V. Jones, Clarendon Laboratory, Oxford, thermoelectric cells for radiation intensity measurements. The British Electrical and Allied Industries Research Association, cathode-ray relay tube designed to pick out accurately points on a current or voltage wave near the zero value (Mr. A. M. Cassie), and apparatus for testing thin dielectrics at high field strengths (Mr. A. M. Thomas and Dr. S. Whitehead).

The Wilson Laboratories, London, television projection receiver, and Mr. A. C. Downing, University College, London, a sensitive moving-coil galvanometer. Prof. L. S. Palmer and Messrs. D. Taylor and Roy Witty, University College, Hull, ultra-short wireless waves in water, illustrating the current distribution round short-wave frame aerials. The Edison Swan Electric Co., Ltd., cathode-ray tube apparatus.

Prof. J. K. Catterson-Smith, King's College, London, mercury-arc grid-controlled power rectifier. Mr. R. O. L. Curry and Dr. E. G. Richardson, Armstrong College, Newcastle, cathode-ray tube for speech analysis. Cancer Hospital, London, a condenser-voltmeter "dosemeter."

G.P.O. Engineering Research Station, thermionic oscillators with automatic control of output and purity, to give constant output irrespective of load and supply voltages; rectifier network for correcting valve distortion in an amplifier; control of a.c. transmission loss in a rectifier system by d.c. and its application to carrier modulation; apparatus for determining the individual magnitudes of the sinusoidal components of an audio-frequency current; voice-frequency signalling for on-demand trunk telephony.

British Thomson-Houston Co., Ltd., thyratron-controlled electric-arc spot welder, "Glyptal" synthetic resin, non-electronic radiation relay. General Electric Co., Ltd., semi-automatic light distribution photometer, precision testing of linearity of photo-electric cell response, rectifier photo-electric cells, ripple and striated discharges in rare gases.

The National Physical Laboratory, measuring thermal conductivity and heat of combustion gases, a 20,000-A shielded current transformer, automatic counting and timing mechanism for testing electricity meters, a portable photo-electric photometer, radio apparatus, &c. Imperial College of Science and Technology, London, patterns and models illustrating electron diffraction, electron microscope, method of projecting thermionic valve characteristics, and relaxation oscillators.

Mr. W. Llowarch, Oundle School, gramophone pick-up used as an oscillograph to illustrate the variable-area method of sound recording and for projecting wave-forms; Mr. T. B. Vinycomb, a simple absolute ampere balance; Mr. D. G. A. Dyson, King Edward VI School, Stratford-on-Avon, a motor-driven flicker photometer; and Dr. N. L. Yates-Fish, University College, London, demonstration of the properties of short waves.

Rotax, Ltd.

Besides rotary transformers and high-voltage generators for radio purposes, both normal and high-frequency portable electric tools are shown. Aircraft-lighting dynamos are of the engine-driven type, with a third brush for voltage regulation, and the wind-driven pattern, which can be wound either as a constant-current or constant-voltage machine. An aero-engine starter is made with the high initial cranking speed of 80 r.p.m., the effort required being independent of the engine stiffness.

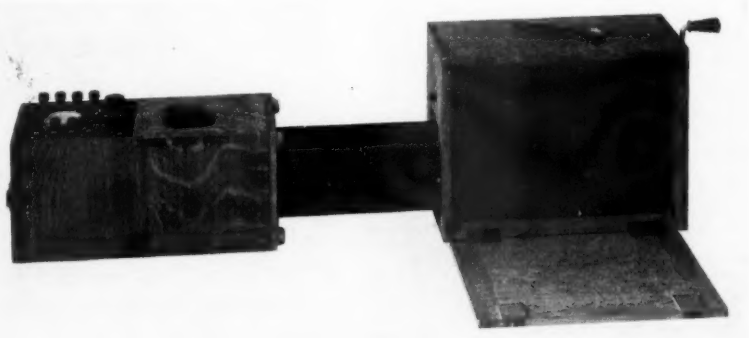
Salford Electrical Instruments, Ltd.

New instruments are housed in 2½ in. cases, but a new line of 3¼ in. metal case instruments, either round or rectangular, gives a greater scale length without undue increase of bulk. A useful range of portable illumination meters is now available utilising a new type of photo-cell of large output coupled direct to a sensitive moving-coil instrument; batteries, amplifiers, and auxiliary control apparatus are not required. They include a pocket-size type of foot-candle meter that can be closed up when not in use. No wires are exposed, the connections being taken through a specially constructed hinge and the photo-cell fixed in the lid. A photo-cell is also used in an exposure meter which has wide applications for photography, its size being even smaller than that of the 2½ in. instrument. A new application is the reflection meter which is used for measuring the reflection properties of surfaces; it incorporates a small electric light at the centre of an annular photo-cell, which is placed against the surface; the reading gives the relative reflection compared with a standard white surface.

A new remote indicating tachometer consists of a small a.c. generator with adjustable air gap connected in the housing to a full-wave metal rectifier.

Apparatus for laboratory and test purposes in which thermionic valves or bridge circuits are employed is constructed on a new principle in all-metal containers.

Among magnetic dust core materials for all frequency ranges between 200 and 2,000,000 cycles is "Gecalloy" pressed dust, which has hitherto been made for telephone frequencies only, but is now produced in different grades for any required waveband. "Ferrocart," made in sheet or tube form, is especially useful at radio frequencies.



Standard camera for cathode-ray oscillograph equipment

Standard Telephones & Cables, Ltd.

This company's cathode-ray oscillograph equipment covers a complete range

of units by means of which all manner of tests and experiments can be conducted. To the nucleus can be added other units for special work. Thus, a dual wave unit, which is exhibited for the first time this year, enables two independent circuits to be alternately switched on to the oscillograph, the process being repeated rapidly a number of times per second, so that the two wave forms appear superimposed. This device enables the phase relationship existing between currents and voltages in a.c. networks to be shown.

The whole of the operation of a new film camera, from loading to developing, can be carried out in broad daylight.

A small portable noise meter makes use of an offset head receiver and incorporates a commutator to produce a standard reference tone, the loudness of which is adjusted until it is just not masked by the noise under measurement.

A completely self-contained instrument with which measurements of loss, level, and gain may be made over the voice-frequency range without the aid of any additional apparatus can be used for all kinds of transmission measurements, such as for the quick determination of transmission faults on remote control systems, for the location of operational faults on automatic systems, &c.

Portable equipment for the direct measurement of the percentage of telegraph "time" distortion, as defined by the C.C.I.T., present in any telegraph channel of an improved type is shown.

A signal generator test set has been designed for large radio service stations and factories to enable all kinds of measurements to be made, such as the alignment, selectivity, and sensitivity of any type of radio receiver. Built on the unit construction principle, it is flexible to use, as units may be added at any time to provide further facilities. There is also a small portable equipment which provides a source of modulated radio-frequency energy variable in respect of both frequency and voltage amplitude, and a meter for measuring audio-frequency output from the radio receiver under test.

A high-quality microphone amplifier and telephone receiver uses a moving-coil microphone with an extremely flat characteristic within ±2.5 db from 30 to 10,000 p's.

H. W. Sullivan, Ltd.

In addition to crystal and fork frequency standards and wavemeters, inductance and capacity standards for all frequencies, capacity bridges and test sets, audio-oscillators and a.c. bridges, &c., there will be shown a new inexpensive portable telephone cable capacity unbalance testing set which enables long sections of cable to be tested with increased accuracy.

Taylor, Taylor & Hobson, Ltd.

Multiple "javelin" etching hard and soft metal by means of the electric arc process is rapid and economical. The machine on view will simultaneously etch fifteen stainless table knives, or similar articles, in the finished mirror-polished condition, complete with handles. All the electrodes are controlled in unison by pantograph, following the contour of the master pattern template. Thin and fragile articles can be marked neatly without distortion or risk of spoiling the work.

Telegraph Construction & Maintenance Co., Ltd.

This exhibit will include high-permeability nickel-iron alloys and resistance materials, mumetal and magnetic alloys, with samples of instruments and equipment incorporating them; also a specimen of the 1933 Anglo-French telephone cable.

H. Tinsley & Co.

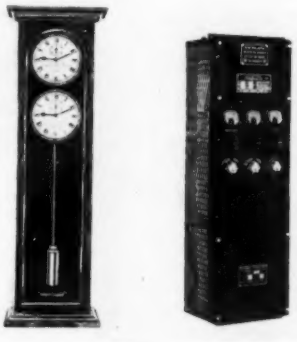
Measuring instruments and students' apparatus will include a vector voltmeter, potentiometers, valve microvoltmeter, harmonic analyser, a capacity meter for mass-produced condensers, galvanometers, and laboratory standards.

Ernest Turner Elecl. Instruments, Ltd.

In this comprehensive group are miniature instruments in bakelite cases of B.S.I. first-grade accuracy and an average weight of about 3,75 oz., and d.c. moving-coil relays and galvanometers. Electrical tachometers and speed indicators are made with an a.c. generator having stationary windings and a moving-iron indicator that keeps the pointer very dead beat; the scale is nearly linear. Switchboard instruments in moulded bakelite cases for flush and surface mounting have a body diameter of 5.8 in. and a scale length of approximately 5.75 in., this range also including metal rectifiers and thermocouples for radio-frequency measurements.

Venner Time Switches, Ltd.

In this selection of time switches for street lighting and similar purposes are hand and electrically wound a.c. and d.c. types, some fitted with synchronous



Left: The Venner frequency-controlling clock. Right: A "Keepalite" panel with Westinghouse rectifiers

motors and others with solar dials, or dials on which a weekly programme can be preset. Switches include the oil-break heavy-duty pattern, wireless lighthouse type, and flashers for signs.

Among relays is a type for controlling water heating in conjunction with street lighting, as used in New Zealand, and for the illumination of G.P.O. telephone kiosks. Stop-watches are made with an open dial, which is easily read, and there is an electrically operated pattern and a direction-finding watch compass.

Meters of the prepayment, fixed and running charge, rent collection, "Rad-slot," "Wrad-slot," and "Cost-i-Meter" patterns are made. The last-mentioned is for showroom purposes to demonstrate to prospective consumers the time against cost of running apparatus. A frequency control clock has two faces, one of which shows the correct time, the other being synchronous motor-driven from the supply to be controlled. An hour meter records operations in terms of hours up to 1,000 hours, and a tramcar recorder checks the time at which a vehicle passes a certain point.

Westinghouse Brake & Saxby Signal Co.

Recorders and a.c. measuring instruments incorporating this company's metal rectifiers are exhibited by at least nine manufacturers. Rectifiers of very small dimensions, designed to reduce stray electrostatic capacity, are now in commercial production, and a type having a very low voltage regulation has been placed on the market for operating "Class B" radio amplifiers.

The range of "Westectors" for operating radio receivers has been extended by the addition of extremely small types developed for rectification at frequencies of the order of 100 kc. and upwards, and it is hoped to show 1,000-kc. models for automatic volume control.

A new type of high-voltage metal rectifier has been designed to pass 10 mA for X-ray work, cathode-ray oscillographs, and gas-discharge processes. Emergency lighting equipment has been developed that utilises a control panel incorporating a metal rectifier, which keeps the stand-by battery fully charged.

Contact studs taken from the motor circuit of an automatic temperature controller demonstrate the use of a metal rectifier as an inductive energy absorber.

Weston Electrical Instrument Co., Ltd.

Portable and switchboard moving-coil, moving-iron, and dynamometer ammeters, voltmeters and wattmeters range from laboratory standards, having a guaranteed accuracy of 1/10th per cent., to small instruments specially developed for radio work, which have guaranteed accuracies of 2 per cent. The new model E.45 is a portable d.c. moving-coil ammeter, with a guaranteed accuracy of ½ per cent.

Model E.600 is a specially sensitive miniature instrument which can be made with a sensitivity as high as 30 mA full scale deflection. Among illumination meters model E.603 is now made as a four-range instrument with a lowest range of 0-2.5 foot candles, in addition to the three-range instrument introduced last year. Model E.703 is a small portable direct-reading illumination meter with a coloured scale specially marked to indicate levels of illumination required for various conditions.

The radio instruments include a new analyser (model E.665) for "servicing" radio sets. In addition to the comprehensive set of a.c., d.c., and ohm ranges, it is supplied complete with selector units and adaptors which enable rapid measurements to be made on valves and sets under actual working conditions.

A comprehensive range of instruments has been developed for aircraft use.

Wild-Barfield Electric Furnaces, Ltd.

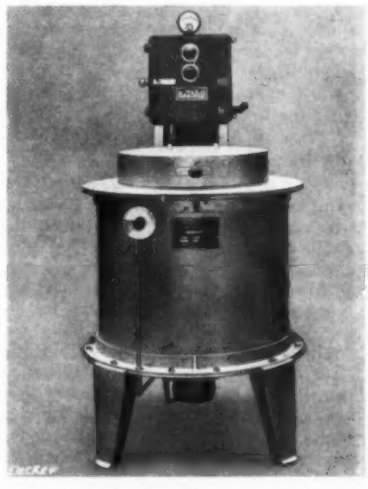
The "TRT" toolroom tempering equipment, while having all the advantages of forced air circulation, is obtainable at a figure commensurate with the small work with which it has to deal. It is compact and occupies little floor space. The cylindrical chamber is fitted at the bottom with the Wild-Barfield patent centrifugal fan, and immediately above is an inner refractory container. The exterior surface has a continuous groove moulded round it, in which a heavy nickel-chromium heating element is wound. The air returns downwards through the central space, wherein the work is placed, and so imparts the heat uniformly and rapidly.

Laboratory muffles of various types and sizes are to be shown in operation.

Zenith Electric Co., Ltd.

New designs of sliding resistances, incorporating novel features, ensure smoother regulation, longer life, and lower cost. Types on steel and porcelain formers for front-of-panel and back-of-panel mounting have automatic clutches to prevent overturning. Laboratory resistances with special ventilated enclosures eliminate danger of shock. There is also a large range of alternative types with non-inductive and capacity-free windings, and examples of resistance heaters adapted to special purposes, such as oil engine starting and the vaporising of volatile fuels.

"Zenite" and other cartridge-type wire-wound resistance units with low self-capacity and inductance are available for



A Wild-Barfield toolroom tempering furnace

research and laboratory use, besides "Zenohm" heavy duty corrugated strip resistances for controlling the temperature of large electrically heated muffles, and "Vit-bond" wire-wound vitreous embedded resistance units.

Transformers with sliding contact adjustment afford complete control of secondary voltage from zero to the maximum. Phase-shifting current and potential transformers are shown, together with a complete testing equipment for calibrating integrating wattmeters, power-factor indicators, and other electrical measuring instruments, besides a portable load-testing set for house service meters, and dry insulation high-voltage transformers for spectroscopic work.

Safety and Sufficiency of Supply

The new regulations of the Electricity Commissioners

NEW regulations have been made by the Electricity Commissioners for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy ("The Electricity Supply Regulations, 1934," H.M. Stationery Office, 6d.). They come into force generally on January 15th next with regard to works brought into use on and after that date, but not until January 1st, 1935, for existing works and supplies. Overhead lines (electric lines placed above ground and in the open air) and consumers' installations covered by the Home Office and Mines Department Electricity Regulations are excluded from their scope.

The new regulations differ radically in arrangement from those which they supersede and contain many important alterations. Low voltage is defined as 250 V and under and medium voltage is above 250 but less than 650 V; high-voltage is 650 V and over, and now by implication includes what was formerly called "extra high voltage," that is, 3,000 V and above.

The insulation resistance of all circuits of the undertaking for low and medium voltages must be tested *in situ* before use, the tests being those of the B.S.I., or, where none is prescribed, a minimum of 500-V continuous application for fifteen minutes between conductors and between conductors and earth. The leakage current for l.v. and m.v. systems is not to exceed one-thousandth part of the maximum supply current. The voltage between earth and any conductor of a medium-voltage system is not to exceed low voltage.

An a.c. system exceeding 125 V and any system at medium voltage shall be earthed at one point only, but sanction may be obtained for multiple-earthing. The external conductor of a concentric cable is the one to be earthed. Earth connections may be broken only for testing or fault location. An ammeter for recording leakage current is to be permanently in circuit with the earth connection on a d.c. system. A fuse or automatic switch may be inserted in the earth connection of a d.c. three-wire system parallel with a resistance of not more than one ohm, but neither of these nor any impedance may be inserted in the earth connection of an a.c. system (l.v. or m.v.).

Similar tests before use are required for h.v. circuits, except that in the absence of a B.S.I. test an a.c. voltage is to be continuously applied for fifteen minutes that is at least 1¼ times the working voltage or working voltage plus 10,000 (whichever is the less), but variations are provided for in certain cases.

Every h.v. line and its associated apparatus must be so equipped as to ensure an immediate and safe discharge of excess leakage. H.v. lines (other than those overhead or in generating stations and sub-stations) shall be enclosed in earthed metal sheathing; fault current shall be not less than twice the setting of automatic cut-outs. A point of every h.v. system shall be earthed, but sanction to multiple-earthing is obtainable.

Outdoor Sub-stations

Outdoor sub-stations shall be protected by fencing at least 8 ft. high, except where the apparatus is enclosed and connected by armoured cables. Underground street boxes containing transformers must not also contain switches or other apparatus. H.v. lines (other than overhead) and apparatus on a consumer's premises shall be enclosed in fire-resisting casings, preferably of earthed metal.

Where h.v. energy is transformed or controlled in street boxes or on a consumer's premises, the opening of doors or covers must require a special key and must not expose the operator to contact with h.v. conductors. Unless all enclosed conductors and apparatus can be made dead for cleaning, &c., they must be divided into screened sections. Fuses shall be controlled by switches if they cannot otherwise be renewed without danger.

On the supports of h.v. overhead lines, the conductors, transformers and switches (unless enclosed and connected by armoured cables) shall be so arranged that no live metal is less than 15 ft. from the ground or from any place accessible to an unauthorised person, or less than 8 ft. from an operating platform. Provision must be made (preferably by earthing a point on the l.v. system) to prevent the voltage on the l.v. system rising due to leakage from the h.v. system of a transformer.

All lines shall comply with the appropriate B.S. Specifications or be approved by the Commissioners. Every circuit of the undertaking and associated apparatus shall be protected against excess energy by a fuse or automatic breaker of adequate rupturing capacity, but these must not be inserted in the earth connection of a concentric system. Where any line (other than an overhead line) crosses or is near any metal, the latter (unless used as a conductor) shall be earthed if necessary to prevent danger.

Provision is to be made for draining oil which may leak from transformer or switch tanks of more than 2,000-gal. capacity, and provision is to be made to extinguish fire. Spare oil must not be stored in any such sub-station or switch station.

The Testing of Bitumen Cables

Lines protected by bituminous material (instead of by earthed metal) and brought into use before the date of the regulations are to be frequently tested for insulation resistance, and any conduit containing them shall be sealed at its point of entry into a street box to prevent a flow of gas from the latter. No new lines protected by material liable to produce noxious gases on excessive heating shall be brought into use. Lines of different systems passing through the same street box must be readily distinguishable.

The undertaking's system shall be sectionalised by circuit-breakers or fuses so as to restrict the extent of the area affected by a failure. There must be no risk of influx of gas at the point of entry of services into consumers' premises below ground level. The polarity or phases of the separate service conductors shall be distinctively indicated near the supply terminals. An enclosed and sealed fuse or automatic breaker shall be inserted by the undertaking in each service line near the supply terminals, but not in a neutral conductor at a point common to more than one pair of conductors of a three-wire or multi-phase system. If a h.v. supply is given, provision must be made to isolate the fuse or breaker and to enable the consumer to cut off all voltage from the supply terminals. The undertaking is responsible for installing and maintaining lines and apparatus on a consumer's premises that are its property or under its control, but subject to the terms of hire or hire-purchase agreements; compliance with the (I.E.E.) Regulations for the Equipment of Buildings fulfils this requirement.

Supervision of Consumers' Installations

Permanent connection of a consumer's installation may not be made if connection would cause a leakage of one ten-thousandth part of the maximum current supplied to it. The undertaking is not compelled to supply unless (1) all conductors and apparatus are sufficient in size and power and are free from danger; (2) every distinct circuit is protected by a fuse or automatic breaker that would prevent danger from overheating, arcing, or the scattering of hot metal, and that would permit the safe renewal of the fuse; (3) every motor is controlled by a switch that can be easily worked by the operator. Here, again, compliance with the I.E.E. Regulations meets the case.

A l.v. supply shall not be given for more than one phase or outer unless the installation exceeds 15 kW and then only if this is necessary to keep voltage variations within the prescribed limits.

The undertaking need not give a l.v. supply from more than one phase or outer unless: (1) the supply terminals are arranged in separate pairs to avoid danger of a m.v. shock; (2) the different phases or outers of the consumer's wiring are kept distinct or comply with the requirements of m.v. supply; (3) apparatus connected to different phases or outers must be not less than 6 ft. apart, unless the metal framework is earthed and flexible connectors are protected from mechanical damage. A metallic protective covering must be earthed but must not be the only means of earthing the framework of the apparatus. Compliance with the I.E.E. Regulations also meets the case.

The undertaking need not give a m.v. supply unless: (1) all non-current carrying metal associated with the consumer's installation is earthed; (2) the wiring is enclosed in electrically continuous strong metal casing or is so installed as to prevent danger; (3) the supply to each appliance (including associated devices) is controlled by a switch easily worked by the operator. Compliance with the I.E.E. Regulations would meet these requirements.

The undertaking shall not give a h.v. supply unless: (a) all conductors are inaccessible to the consumer; (b) the consumer guarantees (in writing) that whenever the supply is being used an authorised person will be in charge of the h.v. installation, which will be maintained to the satisfaction of the undertaking, and that instructions regarding electric shock treatment shall be displayed; (c) with the consent of the Commissioners, for water heating when a live element is in direct contact with the water.

(*Continued at foot of next page.*)

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

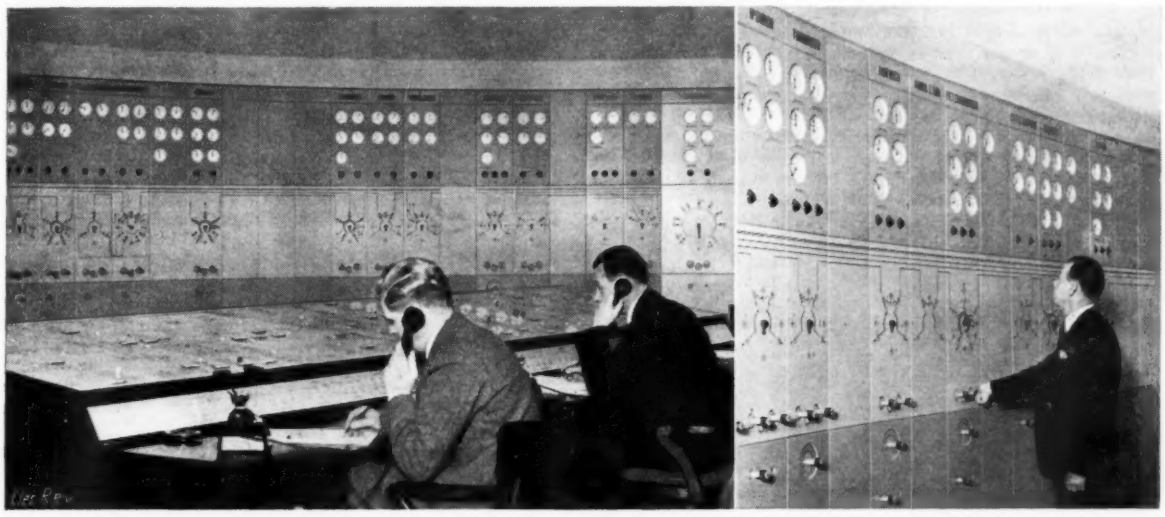
The Economic Design of Radio Beam Arrays

THE designer of radio aerial beam arrays needs to know the anticipated performance and cost of each section of complete array systems, to enable him to arrange an equable balance between gain in distant field strength and capital outlay needed to obtain this gain. The factors concerned in the solution of the problem are (1) the angle of elevation of the axis of the main lobe of radiation of the beam to give the highest gain in field; (2) the economical design, fabrication, and erection of structures to support the array; and (3) the most economical type of feeders and transmission lines to use, having regard to the energy losses and pick-up of the lines.

These three factors are considered in the paper, by Mr. T. Walmsley, which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 3rd. From the results of the investigation, deductions are drawn regarding the gain of a horizontal type of array composed of numbers of half-wave radiators grouped in various ways. It is shown that the cost of array systems increases rapidly not only with wavelength but also with the angle to the vertical at which energy is projected or received.

The main conclusions are that before the design of an array system is undertaken, tests should be made over several months to decide upon the best angle of propagation in the vertical plane. If this varies appreciably with the seasons, as in the case of the Rugby-Berlin circuit, several arrays having various angles of projection and reception, or one array capable of having its angle varied, should be built. In the case of the Rugby-New York circuit, the angle of projection averaged over periods of a few minutes on the wavelength tested (20.78 m) varied very little over a yearly period, its average value being about 79 deg. to the vertical.

When the direction of maximum radiation from an array coincides with the preferential direction of projection the received field strength is the maximum. Increasing the height of the radiators raises the cost of structures and reduces the received field strength.



Commercial operation of the N.W., S.E. and East England sections of the grid commenced on Monday last. Our pictures show the control room at Bankside, London: the left-hand one is the connection between the S.E. and East England systems

Reinforced Concrete Poles for Transmission Lines

A PAPER on reinforced concrete poles for distribution and transmission lines, by Mr. A. J. Martin, of Ceylon, was read recently before the OVERHEAD LINES ASSOCIATION in London. The paper was presented on behalf of the author by Mr. W. H. Grimmitt.

The solid type of reinforced concrete pole was dealt with. In general, reinforced concrete poles found their most economical use in distribution systems utilising poles of from 27 to 36 ft. where spans ranged from 100 to 300 ft. Though the cost of handling concrete poles was heavy, this was off-set by the decided advantage over steel in first cost, depreciation and maintenance charges. Comparative costs were given of 29-ft. steel and reinforced concrete poles, erected in Ceylon, having a crippling strength of 1,000 lb., and it was pointed out that there were no maintenance costs for the concrete posts. The figures showed an initial saving of 3.25 rupees per pole (as erected) in favour of the concrete poles, and a recurrent saving (on depreciation and maintenance costs) of 3.26 rupees.

Wooden cross-arms on concrete posts cost half as much as steel, and well-seasoned teak, having two coats of good paint applied every two or three years, had lasted over fifteen years. Concrete poles did not require concrete plinths to protect them at ground level, as did steel poles. Of the solid

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Safety and Sufficiency of Supply *(continued from opposite page)*

The undertaking is not compelled to give a h.v. supply unless: (1) live metal work cannot normally be exposed to the touch; (2) h.v. conductors (other than overhead lines) are enclosed in electrically continuous metal; (3) non-current carrying metal is earthed; (4) the supply to all separate apparatus (including associated devices) is controlled by a switch easily worked by the operator; (5) h.v. windings within reach of the operator are so protected as to prevent danger; (6) the l.v. system of transformed energy is earthed at some point; (7) the conductors and apparatus can be made dead in screened sections, unless the whole installation can be cut off for cleaning, &c.; (8) a working space is provided in front of any switchboard (other than panels for controlling l.v. circuits) and where live conductors can be exposed; (9) unauthorised persons are prevented from having access to the h.v. installation.

A supply need not be given for stepping up to a higher voltage for a luminous-tube sign on the outside of any premises unless: (1) switches on the lower-voltage side are placed accessibly both inside and outside the premises; (2) exposed h.v. conductors cannot normally be touched; (3) h.v. conductors (other than overhead lines and series conductors connecting parts of signs) are enclosed in electrically continuous metal; (4) the other requirements for h.v. working are met.

If the leakage on a consumer's installation exceeds that permissible, the undertaking may in emergency forthwith discontinue the supply, giving written notice of the reason to the consumer. Before beginning to supply a consumer, the undertaking must declare whether the system is d.c. or a.c. (including the number of phases and the frequency) and voltage. The maximum permissible variation of frequency is $\pm 2\frac{1}{2}$ per cent. and of voltage ± 6 per cent., but the $12\frac{1}{2}$ per cent. excess over the minimum declared voltage for supplies at 3,000 V and over shall be retained for existing supplies.

The polarity of d.c. and the neutral conductor of a.c. distributors may not be changed without the consent of the Commissioners except for testing, when twenty-four hours' notice to consumers is required. Undertakings must send immediate notice to the Commissioners of any accident that might possibly have caused loss of life or injury.

reinforced concrete poles, the octagonal and the H-section appeared to be the best with regard to weight and strength.

The economic percentage of steel to concrete varied from 1.5 to 5, depending on the section and the loading of the pole. Generally speaking, circular spun poles contained a higher percentage than the normally cast poles. In Ceylon, where spans were small, conductors were light, and the activities of white ants had to be guarded against, the use of concrete poles was economical. But when making comparisons it should be remembered that timber poles in this country were carrying lines with spans of from 350 to 500 ft.; such spans, on single timber poles, were practically unknown outside England.

The author insisted that the best grade of Portland cement, specially manufactured for reinforcement work, should be used.

Careful handling and efficient curing of the poles were necessary. "Ferrocrete" poles were left in their moulds from two to four days after casting, and kept moist. Then they were transferred to curing or pickling tanks, the beds of which were covered with sand. The poles should be carried on the mould base and gently rolled into the tank. They were left under water from seven to ten days, and afterwards stored for about a month. There was no danger of permanent set in the poles after a gale, if they were well designed, with a factor of safety of 2½ on the elastic limit.

The Causes of Cracks

Longitudinal cracks were sometimes observed, and it was more than possible, apart from bad design and workmanship, that they had been caused by a leaky insulator at the top of the pole conducting electricity to the metal pin and then through the reinforcement to earth. A potential of 2 V had been found sufficient to start cracks. Horizontal cracks were usually due to the pole being over-stressed. All cracks should be filled in immediately with cement mortar to prevent moisture entering. Cracks were formed most commonly by branches or small trees falling on the lines, but as a rule, if the weight were removed, the cracks closed up so well that they were extremely difficult to see.

The effect of lightning on concrete poles had not been serious. Failures of poles situated near the sea were mentioned; in one case over fifty concrete poles failed completely after eighteen months' use. They were made with ordinary Portland cement, in 1:2:4 mixture, and were erected after only one month. The author had no doubt that they had cracked during handling, thus making it easy for salt moisture to start corrosion. Poles of the same batch, situated 200 yards inland, were not so badly damaged.

The author's recommendations for poles to be used near the sea were that the mixture should be rich and that rapid-hardening cement be used. Fine sand must not be used because it caused seepage; the reinforcement must be placed centrally, and a cover of at least 1 in. to 1¼ in. allowed. The main causes of failure were stated to be: (1) insufficient cover of the steel reinforcement; (2) porous concrete due to poor grading or other causes; (3) unsuitable types of reinforcement; (4) stray electric currents giving rise to electrolysis; (5) lightning.

Discussion

Mr. Grimmitt pointed out that, owing to the very high standard set by the British Post Office in timber pole construction, and in the preservation of poles, we in this country had a very perfect type of line support.

Major T. Rich, President, said he understood that when hair cracks occurred in concrete they tended to cement up again. The use of concrete bases for wooden posts was a compromise which seemed to be worth while. Good timber was not available so frequently as it was formerly, so that there was a tendency for prices to rise, thus bringing wood poles nearer to the cost of concrete.

Mr. A. T. Scott said that electrolysis through leakage was more severe with d.c. than with a.c., but it did occur with a.c. Bonding should be done outside and not inside; the steelwork on the inside must be insulated from the ground and from any metal which might possibly become alive, otherwise there would be cracking and disintegration.

Mr. Jocelyn Swan said that a large reduction would have to be made in the price of concrete poles before they could compete with wooden poles for light rural lines. On his lines, where the spans varied from 350 to 450 ft., 30-ft. wooden poles gave results well within the Commissioners' requirements, and they cost from 35s. to 40s. They were red fir, treated with creosote, and had long life. He was experimenting with larch poles; it was said that an uncreosoted larch pole was good for five years; a larch pole dipped in creosote for a few hours and boiled would last fifteen years; and one which was incised and creosoted under pressure would last as long as thirty years.

Mr. Grimmitt said that about eight years ago he had designed some concrete bases, which were to be pre-cast and shipped to site, but the price for the base and pole was greater than that of the normal pole. Mr. J. G. Griffin pointed out that a large number of wooden poles were used on concrete bases in France, and seemed to give good results. Such poles should be much cheaper than normal poles, for they were shorter and were of smaller diameter at the bottom.

Transmission-line Travelling Waves

TWO papers were presented at the January 4th meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London. In the first Dr. J. H. Miller reviews the causes and characteristics of travelling waves on transmission lines, and demonstrates the method of ascertaining the manner in which they are affected by apparatus associated with the line. He shows how these transient phenomena can be represented mathematically by a combination of two or more exponential functions.

From a general operational impedance equation, involving the Heaviside operator $p=d/dt$, where t represents time in seconds, the particular operational equations of the four illustrative circuits chosen, each of typical wave form, can be immediately deduced; and these in turn can be solved by means of further general solutions.

Various circuits connected to transmission lines are then examined and their response to any incident travelling wave is pointed out. Actual values of the magnitudes and durations of these waves are given, and a series of high-speed cathode-ray oscillograms makes interesting comparison with the mathematical results obtained and checks many of the theoretical premises.

The paper could have been considerably shortened by making it purely mathematical.

A High-speed Oscillograph

In the second paper Dr. Miller, in collaboration with Mr. J. E. H. Robinson, discusses the design and operation of a high-speed cathode-ray oscillograph for recording short-time transients.

The essential requirements are stated and consideration is given to the construction of a cold-cathode discharge tube, the disposition of deflection plates, the operation of the time-sweep and beam-trap circuits, and the methods of synchronising these with the transient under examination, leading to voltage division and the delay necessary for synchronisation.

The instrument is suitable for (1) internal electron-blackening photography, a rotatable vacuum joint allowing the plates to be transferred from one chamber to another after exposure, and (2) for outside light-blackening photography through a glass window which fluoresces under the action of the beam so that the film record is obtained by secondary light emission.

Continuous evacuation is provided for, and the vacuum can be quickly broken for changing photographic plates, thus avoiding the customary delay during the cooling down of the pump. The speed of pumping is such that the outfit is ready for operation a few minutes after the renewal of plates.

For varying the aperture, the anode is detachable and a duct round the core provides for internal water cooling.

* * *

A Theory of Wood Decay

In a recent lecture entitled "Christmas Trees and Others" before the South Wales Section of the SOCIETY OF CHEMICAL INDUSTRY, Mr. E. A. Rudge outlined a "theory of inorganic infiltration." Methods of treatment, seasoning, and preservation were largely empirical processes in practice, but decay in general was mainly concluded to be due to organic attack, chiefly by fungi. Recent examination of several cases of wet rot in greenheart, and in pitchpine, showed that in every case the incipient stages of decay were accompanied with the infiltration of certain inorganic salts. Whatever might be the efficacy of creosoting against the attack of micro-organisms, that method of timber preservation had little effect in preventing the movement of inorganic salts under suitably moist conditions. Mr. Rudge introduced a very interesting case of decay, the specimen being the butt of a telegraph pole which had broken after twenty-two years' service due to the formation of ring shakes, which were close together at the outside of the pole, and were progressively wider apart towards the centre. Since the ash-content of the shake was 0.5 per cent., while that of the wood between the shakes was about 0.16 per cent., this example was considered not only as confirmation of the inorganic infiltration theory but also as indicating that something akin to periodic precipitation determined the zones at which incipient weakness developed. The lecturer considered that if wood be regarded in its major reactions as a simple colloid, the process of decay, hitherto regarded as extremely complex, might bear a simple and general interpretation.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

This Prosperity

For a considerable period the Press has been calling attention to the coming prosperity of the electrical industry. It seems, judging from your advertisement columns, that the electricity supply department is not included.

When assistant control engineers are expected to hold "diplomas, degrees, I.E.E. membership, &c.," in order to qualify for the wages of a dustman, it would not appear that the concern offering such "plums" is enjoying very much in the way of prosperity. Possibly the figure-heads are so expensive that nothing remains for the lower-deck, who have to be responsible for operating the concern.

Such conditions certainly offer no inducement for technical men to aspire to degrees or diplomas. Moreover, being engaged on shift duties, the lucky men will not be able to supplement their income by taking up another job, and running it in parallel with their own—say a little fishing research or herring hunting. The smaller the post the more usual it is to see a stipulation that "the successful candidate must devote his whole time to the duties of the office."

The assistant is usually supposed to be capable of acting as control engineer during illness or holidays. The sum of £4 16s. 1d. per week is indeed a princely salary for such a post, and one which shows the value placed by the employers on the technical attainments which they seek. This branch of the national scheme is evidently full of prosperity.

December 27th. M. H

Electrifying North Wales

Referring to my letter appearing in your issue of December 15th, and in reply to the letter by Mr. M. J. Renford in your last issue, I think there has been a little misunderstanding. It is interesting to note that a "high-tension" line (2,300 V) was put into commission in September, 1905, but I wish to make it clear that North Wales, after all, is, I believe, the home of "extra-high-tension" power transmission, the generation and distribution at that time being 10,000 V.

I also believe that I am correct in stating that the early regulations governing the construction of subsequent extra-high-tension lines were based to a large extent on the practices adopted in this "pioneer" scheme. W. V. WAITE.

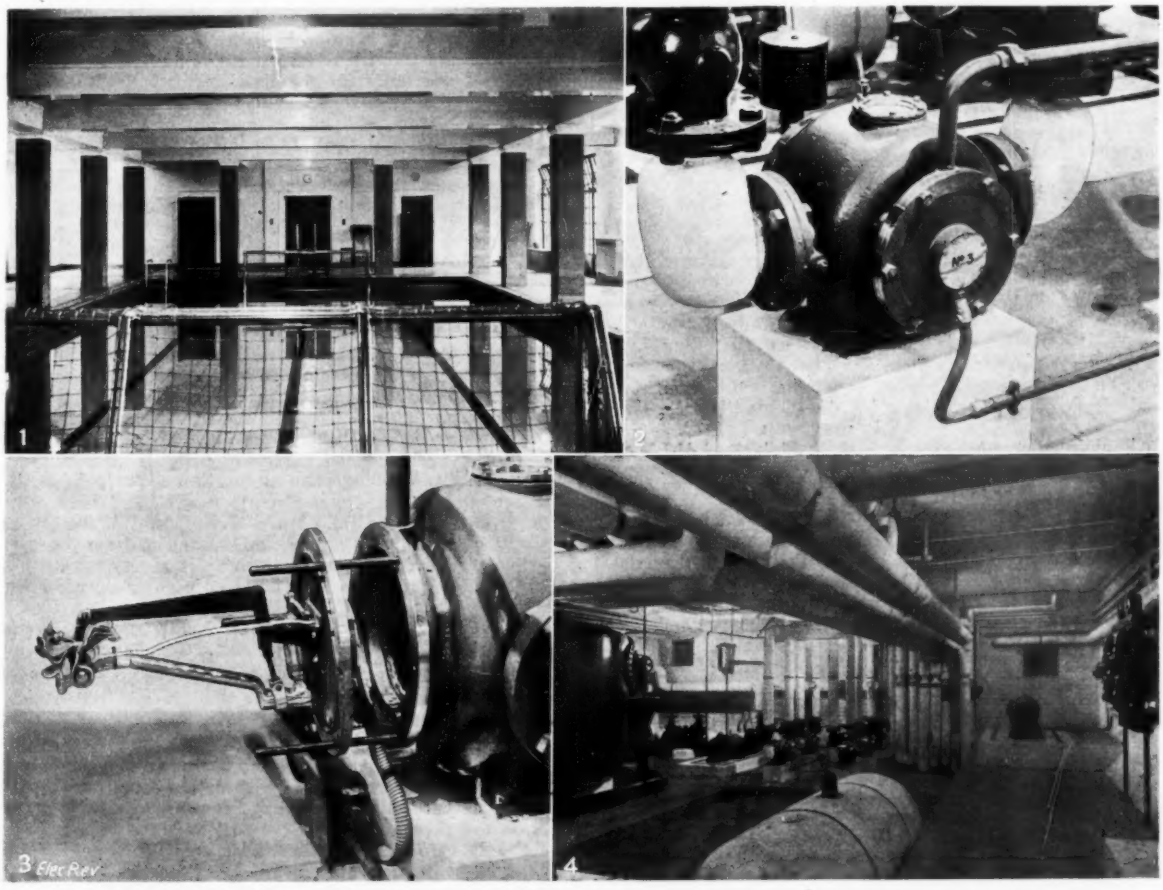
Sheffield, *December 27th.*

Variations in Distribution Voltages

With reference to the leading article in your issue of December 22nd and the recent letters in your correspondence column, automatic tap-changing transformers, voltage regulators, static balancers and boosters, &c., have their uses in special cases. Manufacturers who have them to sell are quite naturally pushing them, but they are costly, introduce additional possibilities of breakdown, and the maintenance costs are not negligible. Personally, I agree with one of your previous correspondents that except in special cases the best practice from every point of view is plenty of copper and transforming points, but here again economics must be considered.

After more than forty years' experience in electricity supply I am quite convinced that on an economic basis the voltage on distribution networks cannot at every point be kept within the prescribed margin of plus or minus 4 per cent. of the declared pressure. Moreover, I am prepared to wager that no electricity supply undertaking of any magnitude in Great Britain is actually doing this, and many of them have given up trying. I am also convinced that such a narrow margin is quite unnecessary, although, of course, a desirable ideal to work towards.

It is possible to keep within the margin on the distributors in concentrated areas, but hopelessly impossible in scattered areas, such as rural districts—particularly in respect of small isolated consumers. Take, for instance, an isolated small house in a rural area, say, 300 yards from the end of the distributor remote from the transforming point. We will assume that the pressure at the transforming point is kept absolutely constant (which is very unlikely) and that at the remote end of the distributor the pressure is minus 4 per cent. Also that a 5-kW cooking load and two 2-kW fires and 1 kW of lighting and water heating load may be on at the same time,



1. The swimming bath at the new medical school, St. Mary's Hospital. 2. Close-up of one of the ultra-violet-ray units. 3. A lamp removed from its quartz cylinder housing. 4. Equipment in the water circulation system: left to right, shingle-bed filter, motor-driven air compressor, centrifugal pump, ultra-violet-ray units and motor-generator **(See page 35)**

making 10 kW in all, *i.e.*, 43 A at 230 V. With an overhead service line of 0.04 sq. in. section, the resistance drop in the service line alone will be 15 V, or 5½ per cent. (actually owing to the inductive drop considerably more), and, therefore, the pressure at the consumer's terminals will probably be minus 12 per cent.

The only possible way to give a plus or minus 4 per cent. supply to such a consumer is to run an e.h.v. service, but having regard to the possible revenue from such a house the cost of the e.h.v. line, transformer and switchgear, and the losses in the transformer this is commercially out of the question. If there is a commercially practicable way to meet such a case on a plus or minus 4 per cent. basis many supply engineers, as well as myself, would like to hear of it.

I think it is high time that the regulations in respect of voltage variation (and many others) were washed out, as like the prohibition law in America, they are impossible to carry out in practice, and therefore are treated as unattainable ideals, and largely disregarded. All such cast-iron regulations, formulated when lighting was practically the only load, are a brake on progress.

Surely the supply engineers can be relied upon in the interest of their undertakings and their consumers to do the best that is commercially possible in each case, for I think that most persons will agree that as a class they are really live and capable men, with up-to-date experience, and therefore should be allowed to do their best in their own way. If not, England will never approach anywhere near the all-electric ideal.

Everyone will agree that even an imperfect electricity supply is infinitely better than none, which is the alternative; and no supply engineer can be expected to go out for business that must inevitably result in a loss, which, of course, is borne by other consumers. Until the permissible variation is largely increased I do not intend to supply many possible consumers.

December 28th, 1933. SUPPLY ENGINEER.

An Ingenious Time Switch

In your current issue Mr. J. W. Meares states that the electrical industry cannot get time switches without paying pounds for them. We would say that for over twelve months we have been supplying a time switch operated by an alarm clock. No mousetrap is used, the clock instead tilting a suitably mounted mercury switch. This has the advantage that it can be used to switch on or off by altering the position of the tube in its clips. The price is 18s. 6d. (list) with clock.

S.F.P. ELECTRICAL CO.

Banbury, *December 29th*. S. F. Philpott, A.M.I.E.E.

Large High-speed Alternators

In an Editorial note on page 904 of the current issue of your paper you say: "The normal rating of the machine would be 70,000 kVA and our records indicate that this is the largest capacity generator ever built to run at 3,000 r.p.m."

It is evident that you have overlooked our full page advertisements which appeared in your issues of September 8th and October 6th, 1933, which illustrated the 71,500-kVA, 3,000-r.p.m. turbo-alternator which we supplied to the St. Denis power station in Paris, and drew attention to the fact that the machine in question was the largest 3,000-r.p.m. turbo-alternator actually in service. It is you will observe 1,500 kVA larger than the machine mentioned in your Editorial as being under construction at Newcastle-on-Tyne.

We would also refer to your current issue (page 905) in which our machine is shown in the foreground in fig. 4 and on page 906 is mentioned as being of 71,400 kVA at 3,000 r.p.m. It is we know your wish that anything which your paper contains should be accurate, and we accordingly thank you in anticipation of your publishing this letter.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI.
John H. Bunting, *British Manager*.

London, S.W.1, *January 1st*.

Earthing Electrodes

Mr. Gilbert's interesting contribution under the above title in your issue of December 22nd conveys, no doubt, quite unintentionally, an impression that a state of complete ignorance prevails upon this all-important subject. Opportunity is taken to draw the author's attention to an E.R.A. Report (Reference F/T59) issued by this Association and published in the June, 1933, issue of the I.E.E. *Journal*, whilst more conclusive evidence on what he regards as speculative aspects of the problem will shortly appear in two articles indicating methods of measuring the resistance of earth electrodes.

Your contributor is no doubt aware that a committee of the E.R.A., representative of the most authoritative knowledge and experience, has been investigating this problem for a considerable time, and while the findings of this body may be found to be consistent with expressions of individual expert opinion as now instanced, it would be both premature and contrary to the practice of the E.R.A. to publish information until it can be presented in a conclusive and definite form.

J. MURPHY,
Secretary to the Council,
Electrical Research Association.

London, W.C.2, *January 1st*.

A Clothes-drying Suggestion

Some short while ago I was faced with the problem of having to find a way of drying the weekly wash indoors owing to bad weather. The problem was solved by the use of an electric fan and one of the radiant boiling plates of a "Hotpoint" cooker. The fan was stood on the hob of the cooker with the propeller deflected at such an angle as to cause the current of air to impinge on the boiling plate.

Normally the boiling plate at full heat glows red hot, but the draught of air kept it down to nearly black heat. The result of this current of warm air circulating in the kitchen was the quick drying of the clothes hanging from the usual ceiling clothes hanger. I commend this suggestion to those who are faced with a similar problem in an all-electric house.

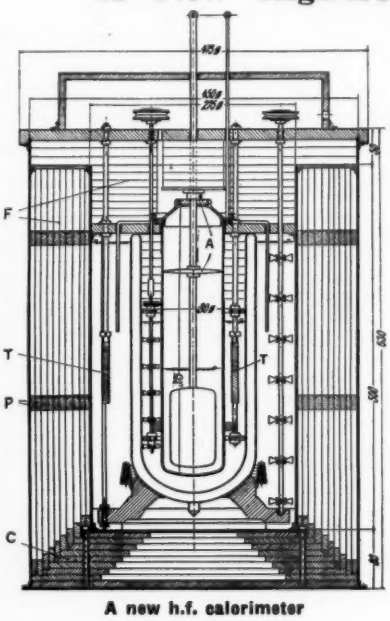
JOHN B. MORGAN,
Electrical Engineer.

Electricity Works, East Grinstead, *December 22nd*.

A New High-frequency Calorimeter

THE calorimetric method is particularly useful in measuring the dielectric losses of liquids at high frequencies, and the accompanying illustration from *Zeitschrift für technischer Physik* shows the construction of a new calorimeter devised by L. Pungs and H Rieche for use at all frequencies from zero (d.c.) up to 50 million cycles per sec., at temperatures from −40 to 80 deg. C. (−40 to 176 deg. F.).

The advantages claimed are rapid transference, to the calorimetric liquid, of heat which is developed by dielectric loss; small supplementary losses; negligible flow of heat to or from surroundings even at high or low temperatures; and applicability over the full range of frequency without any modification of apparatus.



A new h.f. calorimeter

The dimensions on the illustration are in millimetres. The inner electrode is a thin-walled hollow cylinder of gilded brass with a thin tube as connecting stem; this cylinder can easily be changed with another to obtain different values of capacity. The outer electrode, also of gilded brass, serves as receptacle for the liquid under investigation. Petroleum in a vacuum-jacketed vessel is used as calorimetric liquid, and there is an outer vessel filled with petroleum and kept within 0.02 deg. C. of the temperature of the calorimetric liquid by means of a thermostat. Finally, there is a lagging consisting of multiple layers of 0.07 mm. aluminium foil F, with corrugated paper spacing at P, and cork plates at C.

The upper part of the outer electrode is turned thin to reduce the heat flow by conductivity, and there is an inverted brass cup which maintains a jacket of air round the top of this electrode at the temperature of the jacket oil. Belt-driven stirring paddles are provided, and resistance thermometers at T. The amber spacing pieces A are above the level of the calorimetric liquid, so that their losses do not heat it appreciably. A graphic recorder plots the temperature of the calorimetric liquid automatically. The sensitivity is such that it is possible to work with temperature rises of about 0.1 deg. C. and a loss of 0.1 W can be determined accurately within 1 per cent.

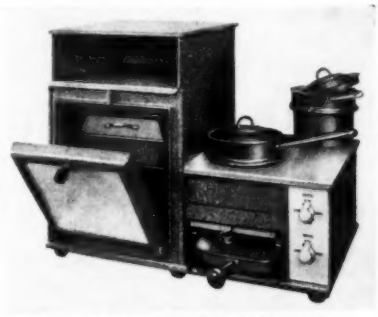
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Redesigned Cooker

In our issue of June 30th last we described the "Chef-Co" bain-marie type cooker, produced by the MANOR ELECTRIC OVEN & FIRE CO., in which both roasting and boiling are carried out in special utensils deeply welled over horizontally disposed elements within a suitable housing.

We now learn from Major C. W. de Roemer, the inventor, that the equipment has since been considerably improved; indeed, the roasting portion has been completely redesigned, cooking now being effected in an oven of the usual construction, but still within the totally enclosed pan which is placed in the oven in the normal way. It is claimed that because of the vaporisation of oil within the covered utensil actual cooking commences sooner and the loadings and the consumption are reduced. The boiling part of the equipment is much the same as that of the original unit.



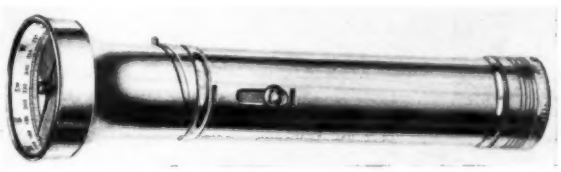
The redesigned "Chef-Co" cooker

The overall dimensions of the new "Chef-Co" are 28 in. wide, 18 in. deep, and 21½ in. high. A total loading of 1,200 W (800 W bottom and 400 W top) serves an oven cooking space of 14½ in. by 11½ in. by 11½ in. The elements are of the "open protected" type. Above the oven there is a hot-cupboard measuring 14 in. by 16 in. by 4½ in. The exterior is practically all vitreous enamelled, and so are the utensils, the inventor claiming that such vessels are more efficient with radiant heating than are aluminium utensils.

The equipment is sold by MESSRS. BAXTER & CAUNTER, LTD., Darnoc House, Alfred Place, W.C.1.

A Torch for "Hikers"

The "Senior Hike-lite" torch has already been described in these columns. The "Junior" model, which has just been introduced by the EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2, is similar in construction, embodying all the features of the focusing types, an all-



The "Junior Hike-lite"

point magnetic compass with the needle pierced at the North end to facilitate reading at night, and a spare bulb. The diameter of the head is 1⅝ in., and the price 4s. 6d., as compared with 2¼ in. and 10s. in the case of the "Senior" model.

Street Island Illumination

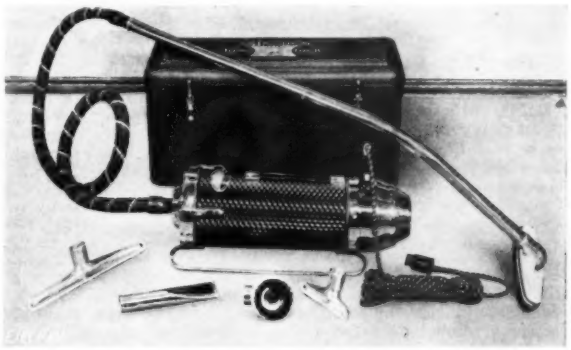
A new method of illuminating street islands, refuges, or central street obstructions has recently been introduced into the main streets of Colchester by Mr. Harold Collins, the borough engineer, in co-operation with the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. In High Street the general lighting is carried out by "Wembley" lanterns. These are mounted on tall standards in the centre of the roadway, which, since the tramways were superseded, have had concrete island bases built round them. When the street lighting is in operation ample illumination prevails everywhere. This main lighting, however, is extinguished at 11.30 p.m., and in order to prevent the risk of accident through collision with the bases a system of pilot lighting now operates on certain of these standards for the guidance of traffic after the main lighting has been extinguished.

A G.E.C. traffic sign

This new lighting consists of illuminated boxes clamped to the standards at eye level. They can be supplied with various directional wording. Those at Colchester bear in black on an orange background a "Keep Left" instruction. The lamp equipment consists of two 40-W "Osram" lamps on each standard, which, besides giving a directional indication, direct a diffused light in a downward direction, so as to illuminate the cast iron ornamental, luminous painted bases of the columns as well as the concrete islands at the foot of each.

The "King Dick" Vacuum Cleaner

From an examination of the new "King Dick" vacuum cleaner made by ABINGDON WORKS (1931), LTD., Tyseley, Birmingham, we gather that no attempt has been made to cheapen the product by the use of inferior quality materials. The cleaner is robustly made with a chromium-plate finish, while the equipment, included in the price of 12 gns., comprises 2 yd. of black and white braided rubber tube, straight and curved metal extension tubes, a length of heavy gauge braided flex fitted at one end with an adaptor containing a push switch marked "on" (in red) and "off" (in black), and a lamp-holder adaptor which is in two parts, enabling it to be used also as a two-pin plug. Nozzle tools 1, 5 and 11 in. wide are included, as well as flat and circular brushes 3 in. in diameter. The whole equipment is contained in a strong and serviceable brown all-metal carrying case.



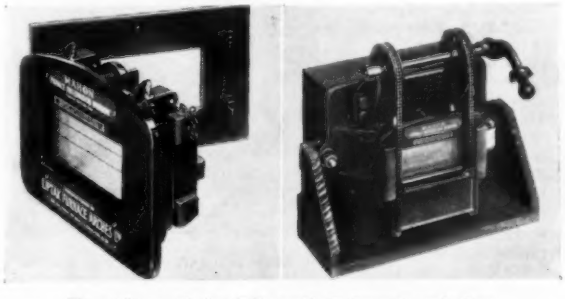
The "King Dick" vacuum cleaner and accessories

Three convenient chromium-plated clips hold the dust bag cover in position, the bag being easily removable after the cover has been taken off, while the tubing, which has slightly tapered rubber ends, fits into moulded sockets at either end of the cleaner, for blowing or suction.

The general appearance is very attractive and the machine is quiet when in operation: as the suction tubing is of rubber the user is always completely isolated electrically from the vacuum cleaner, even when the metal extension tubes are used.

Furnace Windows for Boiler Plant

An efficient inspection window, known as the "Pyroptic" (H. G. B. Mahon patent), supplied by LIPTAK FURNACE ARCHES, LTD., 59, Palace Street, Victoria Street, S.W.1, is fitted permanently in the doors or walls of a boiler and consists of a metal framework holding a comparatively large area of tinted glass through which a complete view of the interior of the furnace is obtained in comfort. The tinted glass is in the form of a composite panel made up of a number of narrow strips fixed horizontally one above the other, with the joining



Two views of the "Pyroptic" furnace window

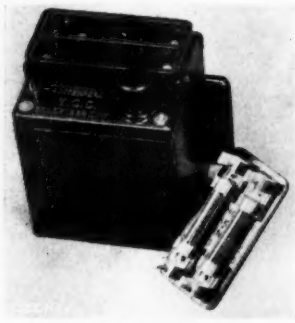
edges bevelled to prevent any white light passing between adjacent strips to the eye. Included also are two ¼-in. thick plates of clear fireproof glass on the furnace side and one similar plate on the outer side, which absorb some of the radiant heat, on the "accumulator" principle, before it reaches the tinted glass. Consequently the latter is kept at a more or less uniform temperature without fear of cracking, and the glass is free to expand and contract.

D

It is claimed that these windows can be exposed for long periods to a temperature as high as 2,800 deg. F. without injury. In one design the composite glass window is hinged on to an adaptor plate so as to allow of easy removal from the frame for cleaning. Another pattern has a heat-resisting metal shutter, which protects the glass from the heat when the window is not being used, attached by two chains to a small overhead shaft with a short lever which is pulled down by hand when an observation has to be made so as to uncover the tinted glass.

An Interference Suppressor for Radio Sets

An anti-interference unit made in accordance with the Post Office specifications and recommendations has been sent to us by the TELEGRAPH CONDENSER CO., LTD., Wales Farm Road, North Acton, W.3. It is a special unit consisting of two non-inductive condensers with fuses in series, a terminal being provided for making a connection to earth from the centre point. Where the unit cannot be connected across the mains at the source of the interference it should be connected across the main switchboard of the house in which the receiver is situated. In the case of a few all-mains sets it may be necessary to connect the unit across the mains terminals of the set if the first two positions fail to effect a cure.

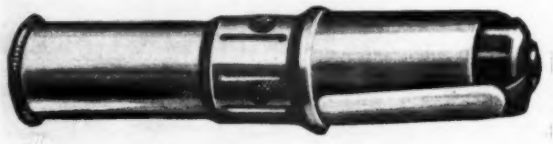


The T.C.C. interference suppressor

The condensers in the unit, each of which is rated at 2 mF, are tested to 1,500 V d.c., and are suitable for working up to 450 V d.c. or 250 V a.c. Two 1-A fuses, which can be easily withdrawn, thus isolating the unit, are incorporated, and when the fuses are in position all "live" parts are completely covered by the green moulded casing. The price of the unit is 10s. 6d.

A Pocket Electric Fan

An interesting device made by the DAIMON FABRIK ELEKTR. APPARATE G.M.B.H. has come to our notice. Actually it is a miniature two-blade fan driven by a small 3-V dry battery. When not in use, the two blades fold up against the body of the case; immediately the switch is depressed a small motor fitted in the head of the case raises the blades and causes them to revolve fast enough to set up a considerable current of air. It is stated that the miniature motor consumes less than half the energy required by a flashlamp bulb. The complete fan measures only a few inches and can easily be carried in the



The "Daimon" pocket fan

waistcoat pocket or in a lady's handbag; a little perfume may be poured into a special hole in the head of the propellor to scent the air. Amusing drawings in the leaflet prepared by the makers show it in use in the cinema, theatre, ballroom, sick room, and railway carriage as well as on the sands and in the desert. The price is Rm.5.

New Pillar Casings

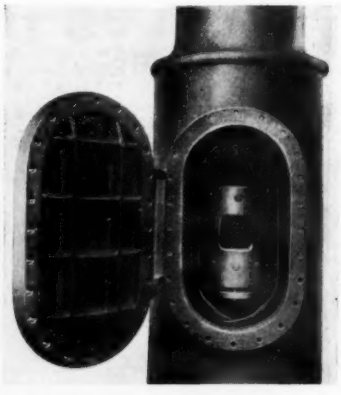
A large range of new pillar casings has been introduced by MESSRS. HARDY & PADMORE, LTD., Worcester Foundry, Worcester. The doors are hinged on a bright mild steel bar running down through a tubular member cast on one vertical edge of the door. Brass bushes are provided at the top and bottom of the door to ensure easy turning on the hinge bar. Top and bottom ventilation of the casing is provided, and the back panel is held on by brass screws. L.C.C. pattern brass turn-buckle locking with removable brass escutcheons is fitted as standard, and there are removable cross pieces under the door and back panel. The casing has a particularly neat appearance and does not show any projecting hinges. The underground portion is made entirely of cast iron, and twelve sizes with either tall or short casings are available as standard.

A new Hardy & Padmore pillar casing

Met.-Vick Developments

OF the heavy engineering plant now on the stocks at the works of the Metropolitan-Vickers Electrical Co., Ltd., the 105,000-kW turbo-alternator and condenser for Battersea is the most notable. An unusual prime-mover is the 24,000-kW, 3,000-r.p.m. back-pressure set for Russia; maximum steam conditions will be 1,760 lb. per sq. in. and 968 deg. F.

The two 60,000-kW units for Fulham are nearing completion; it is claimed that these will be the largest two-cylinder turbines in this country. Other turbines of from 650 kW (pass-out) to 24,000 kW are also under construction. A 1¼-million-kVA, 11-kV, 3,000-r.p.m. alternator for switchgear testing is being built; its dimensions are equivalent to those of a 60,000-kVA machine.



A cross-jet explosion pot inside single-break switch tank

Several large induction motors up to 3,500 h.p. for use with phase advancers are in hand, as well as synchronous induction motors (including one of 7,000 h.p. at 1,000 r.p.m. for Russia); spigots are now used for locating pedestals and brackets. An important development is a single-break oil switch embodying the cross-jet explosion-pot contact, in which the pressure due to the arc projects oil across its path; made for all voltages from 6.6 kV upwards, its chief application will be for 33 kV and above. Orders are in execution for the London Power Co. for twelve metal-clad units with a rupturing capacity of 750,000 kVA at 66 kV.

A new compact single-busbar metal-clad line has been introduced for distribution up to 11 kV, 600 A and 150,000 kVA. Important contracts in hand include thirty-eight 66-kV, 1¼-million-kVA breakers for the new Fulham station, thirty-five units for Bolton, ten for Folkestone (C.E.B.), forty-seven for Laurence, Scott, and twenty-five for Taunton.

For the control of slip-ring motors up to 100 h.p., oil-immersed stator and rotor starters in one case operated by a single handle have been developed. New types of starters have also been introduced for squirrel-cage motors. Automatic and supervisory control gear is being supplied for several sub-stations, and important improvements have been made in protective gear. The meters and instruments now going through the shops contain notable new features. A large number of automatic regulators are being built for special applications as well as for voltage control; these include super excitation with field forcing equipment.

The first metal-clad 132-kV transformer has been installed in Tongland grid sub-station in Scotland. It is connected to its circuit-breaker by 132-kV l.c. cable and (with the other 3,000-kVA units at Glenlee) is the smallest in output yet connected to the 132-kV system; tap-changing is on the l.v. windings. Further work in hand for the grid includes two 15,000-kVA, 132/6.6-kV transformers for Paisley.

Orders for South Africa embrace a 20,000-kVA bank for a synchronous condenser and thirty-two 2,500-kVA, 38-kV three-phase units. A large proportion of the distribution transformers now going through have gang-operated off-circuit tap switches. The past year has seen the completion of a large number of complete rolling-mill equipments mainly for shipment overseas, the largest of the motors having a maximum peak capacity of 13,900 h.p.

Traction activities include improvements in the control gear for the Southern Railway and the Hungarian State Railways, and the construction of trolley-bus and tramway equipment. Industrial electrification (including important textile mills) is bringing large orders to Trafford Park, and there is a marked improvement in marine business. Prominent in the latter section are the equipments for two electrically propelled paddle steamers for the Firth of Forth and turbo-generators and motors for British and foreign navies.

The Research Department has introduced a new cathode-ray oscillograph, a 250-kV X-ray tube, noise-measuring apparatus, and continuously evacuated valves.

English Electric Progress

WORK in progress in the various shops of the English Electric Co., Ltd., includes large switchgear contracts for the Ealing, Leeds and Kettering local authorities, and for the Upper Boat power station (S. Wales Power Co. and C.E.B.), the breakers being of the metal-clad compound-filled type. Seven 44-kV 1¼ million-kVA breakers are being built for the Victoria Falls and Transvaal Power Co. A considerable number of switches embodying "De-ion" grid control are being turned out. An order for a h.v. 100,000-kVA pole-operated non-deteriorating fuse is said to be the largest yet placed for this class of gear in the country.

Several orders for steam turbo-alternators are in hand (some for abroad), but none so large as the 25,000-kW set put into commission at Blackburn Meadows last April. The hydraulic department is busy on work for the equipment for the 57,000-kW Galloway water-power scheme, which is expected to be in service within twelve months. Numerous overseas contracts are in hand for water-power schemes, the largest capacity being two 21,000-h.p. runners for the Arapuni (N.Z.) reaction turbines.

The growing use of the individual drive is bringing in many orders, particularly for fractional h.p. motors and for single- and three-phase capacitor motors, the latter especially for domestic refrigerators. The output of cookers increases every month. Transformer business is active and units down to 100 kVA are being built with on-load tap-changing gear. In addition to the 20,000- and 12,000-kVA transformers supplied to Sheffield Corporation and the West Midlands J.E.A., respectively, the company has recently built three 3,600-kVA automatic induction regulators for controlling grid interconnecting feeders in the London area. Oil-immersed reactors, which the company finds are replacing the air-insulated type, are being installed in a number of undertakings, prominent among which is the Barking station.

Frequency change-over has brought a large order in connection with the Consett Iron Mills, following other contracts from the N.E. Coast which included the conversion of six winder equipments. The erection of the 18,000-h.p. rolling mill for the S.A. Iron and Steel Industrial Corporation is now nearly complete. Orders from home and foreign sources continue to be received for induction roll heaters. Plant ordered for the new Midland Regional broadcasting station includes two h.v. d.c. generators and four 750-kW Diesel sets. Repeat orders for 750-kW Fullagar-engine sets have been received for overseas installation.

Rectifiers are being manufactured in glass-bulb units ranging from 10 A to 500 A and in 1,000 A steel-tank units, several of each type having grid control for d.c. voltage regulation. Seven equipments for three-coach trains have been ordered for India, but the most important traction work in hand is that for the Warsaw suburban railways (jointly with the Met.-Vick.). The 200-h.p. Diesel-electric coach now running on the L.M.S. system was described in our issue of December 22nd. So popular has been the new design of tramcar supplied to Blackpool that twenty-four further cars have been ordered; the Corporation has also ordered a 92-seater open top streamline tramcar. A trolley-bus is being built for routes with low bridges, the first of its type.

The Work of the G.E.C.

AMONG the heavy engineering plant being constructed by the General Electric Co., Ltd., at the present time are several rolling mill and winder equipments. One of the latter, for Southern India (G.E.C.-Fraser Chalmers), will wind 5,300 lb. of ore from a depth of 3,633 ft. at 1,910 ft. per minute. Its 1,150 h.p. d.c. motor, which runs at 37.5 ft. per min., is direct coupled. The driving of what is said to be the largest super-calendering machine in the world (at Aylesford, Kent) has been carried out by a 250-500-h.p. d.c. motor with a speed variation of from 225 to 562 r.p.m. by shunt control. The starting motor-generator produces a starting torque of 5½ times full-load torque, and can supply current to the main motor for crawling at 17.5 r.p.m.

Motor-generators have been ordered by the B.B.C. for supplying filament current to main transmitting valves; one of the generators is insulated from its motor and from earth for 50 kV. There has been a demand for small medium-speed alternators for the Dominions and foreign countries and also for back-pressure turbo sets. Large metal-clad switchboards have recently been installed or are being constructed for Norwich, Bournemouth, Wolverhampton, and other municipalities.

New designs of on-load bus-bar selectors, air-insulated vertical drop-down switches, and 75,000-kVA outdoor oil circuit-breakers have been evolved. A new liquid-immersed h.v. fuse that can be rewired by the user is said to be the first of its kind in this country. An automatic control system has been prepared for the S.A. Iron and Steel Corporation by which a constant supply is obtained from the Pretoria municipal station at unity power factor, the balance being met by the works generators.

The Tyne cable tunnel; two 66-kV oil-filled cables bottom right

Among the traction work carried out have been schemes for the L.M.S. and Metropolitan Railway Companies. The equipment of fifty trolley-buses is being made for Birmingham Corporation. The most important marine electrification work was for the Diesel-electric tug *Acklam Cross*. An order has also been received for a passenger boat for service between Glasgow and Skye.

Apart from improvements in the "Osira" lamp, other new lamps have been introduced, *e.g.*, a 50-V 200-W tubular lamp with prefocus cap offset filament for "home talkies," a 3-kW lamp in a 10-in. diameter bulb, and a 5-kW cinema studio lamp.

During the year the Pirelli-General Co. has completed fifty miles of 33- to 132-kV oil-filled cable in London, Newcastle district, Torquay, &c. Many electric furnaces have been installed: especially remarkable is the Grunewald system for bright annealing. Automatic telephone exchanges have been built for rural areas; in city areas the 10,000-line Kensington exchange is the most notable in this country, the best example of G.E.C. work abroad being the newly commissioned 200-repeater station at Tantah, in Egypt.

A range of small reduction-gear motors has been produced, and improvements have been effected in automatic switching for high-speed gramophone motors. Modifications and improvements have been introduced in small switchgear, installation material, photo cells, radio valves, and other lighter apparatus.

66-kV Three-core Oil-filled Cables

AMONG the oil-filled cables installed by Pirelli-General Cable Works, Ltd., is the 66-kV three-core cable which was put into service in 1931/32 in the Newcastle area, for the Central Electricity Board. This has a cross-sectional area of copper varying from 0.10 to 0.25 sq. in. and a route length of nine miles. A section of this route lay across the River Tyne for connecting the Central Board's switching station at Hebburn to its transforming station at Carville power station, and, as there was no bridge within five miles of the proposed crossing, use had to be made of the North-Eastern Electric Supply Co.'s cable tunnel under the Tyne. Two 0.25 sq. in. three-core oil-filled cables were installed, each capable of carrying a continuous load of 45,000 kVA between the two stations on opposite sides of the river, a route length of 1,570 yds.

The length of each three-core oil-filled cable actually installed in the tunnel was 447 yds., and they were manufactured and laid in position without a joint. The weight of each of these cables was approximately 14 tons, and special precautions had to be taken in lowering them down the shafts and placing them in position on the cable racks in the tunnel.

The accompanying illustration is a view of the cable tunnel, the two oil-filled cables being supported on the two lower racks seen at the right-hand side of the picture.

New Books

Electrical Measurements and Measuring Instruments. By E. W. Golding. Pp. 794; figs. 447. London: Sir Isaac Pitman & Sons. Price 20s.

The subject of electrical measurements covers a very wide range and in this volume Mr. Golding has attempted to cover the whole field. He has managed to compress a great deal into the compass of a single volume. The sub-title of the book describes it as a text-book covering the syllabuses of the B.Sc. (Eng.), City and Guilds (Final) and A.M.I.E.E. examinations in this subject. There are twenty-two chapters extending into nearly 800 pages of letterpress and illustrations.

The task undertaken by the author was no light one, and in the effort to compress some of the value of the work is necessarily lost, and the treatment of the more practical side of the measurements dealt with becomes somewhat incomplete and sketchy; we may quote as examples the treatment of the a.c. bridge, and precise standards of resistance having values of from 1 ohm upwards. There is no mention of the dry rectifier in connection with commercial indicating instruments, and the photo-electric cell receives only passing mention in the chapter on illumination.

A careful examination of the work as a whole leaves us with the feeling that it is somewhat overweighted with a rather extensive and conventional treatment of theoretical matter so that the more practical side of measurement has suffered. More than two pages are devoted to eddy currents in the slot conductors of an alternator treated from the point of view of the dynamo designer. There is neither theory nor measurement here, and we would suggest that in future editions these two pages should be given up to the treatment of commercial instruments which is certainly desirable.

It should, however, be understood that these criticisms in no way detract from the value of the book for the purpose for which it was written. The author has covered the range of the examinations as well as it could be covered in a single volume, and the effects of the compression and omissions are to a considerable extent neutralised by the somewhat extensive, if not complete, bibliography given at the end of each chapter which makes it simple for the student to study the subject in greater detail where he finds it necessary. A collection of questions taken from past examination papers of the London University, City and Guilds, and A.M.I.E.E. examinations are given at the end of the book together with numerical solutions.

Power Sales. By D. Taylor. Pp. 206. London: McGraw-Hill Publishing Co. Price 10s.

A welcome addition to the meagre literature on the systematic development of the power load is found in this well-printed and well-written book. Mr. Taylor has had fifteen years' experience as a power salesman, and now supervises the sales staff of a large syndicate operating in eighteen states of the U.S.A., covering large and small industrial and rural areas. The importance of strong power sales departments has not yet been appreciated here as it has been in America, where the much larger scale of electricity distribution has afforded greater scope for specialised sales staffs. Opinion is, however, being aroused in the matter, and young engineers will do well to equip themselves for the demand which will inevitably arise. Mr. Taylor's book forms an admirable guide.

The author rightly emphasises the desirability of having some knowledge of mechanical engineering rather than a highly specialised electrical training. A close study of plant economics is essential. The actual examples quoted refer to large-scale power problems, and indicate that the author and his staff largely assume the functions of consulting engineers; whether this is desirable is open to question. In any event, the practice presupposes more numerous, more experienced, and better paid sales engineers than are usually employed in "load-building" in this country.

It is interesting to note that the total annual fixed charge against the Diesel engine installation (interest, insurance, taxes, and depreciation) is calculated at 27.7 per cent.—an indication of a lavish scale of values. The different methods recommended for setting out a power report confirm the extreme docility of figures in the hands of expert manipulators. The author's insistence on the need for imagination, courage, and ideas in a power salesman is perhaps the gist of this excellent book. Academic learning alone does not suffice when the "prospects" are still more human than logical. Mr. Taylor's technique, although by no means always adaptable to our own conditions, will reveal many familiar difficulties in a fresh light.

Electrons at Work. By C. R. Underhill. Pp. 312; figs. 42. London: McGraw-Hill Publishing Co. Price 18s.

The author has attempted the difficult task of describing and summarising the vast amount of development which has taken place in the last two decades in the application of modern electronic theory to electrical and physical science. Chapters on dielectrics, alternating currents, space, time and oscillations combine to give the reader an adequate background for the main discussion on the applications of electronic devices to science and industry. Interpretations of the often difficult concepts of energy, potential and capacity are given in semi-popular language but without the usual sacrifice of accuracy.

Three chapters deal with electronic tubes, or, as they are more commonly described in this country, thermionic valves. The author does not limit his discussion only to their uses in wireless transmitting and receiving circuits, but indicates their value for a variety of purposes. Further chapters include discussions on gaseous discharge tubes, photo-electric cells, cathode ray tubes and X-rays. The treatment of photo-electric cells should prove suggestive not only to experimental workers but to those interested in controlling, counting, inspecting, measuring or grading in industry.

Perhaps the chief value of the work lies in the bringing together and summarising within a single volume of much information hitherto available only in original papers, articles and patent specifications. We regret, therefore, that the author has not given more adequate references to the sources of his information as thereby the value of the book would have been enhanced from the point of view of the experimental worker. On the other hand, the index is particularly comprehensive and thus cross-references in the text can be made without difficulty. Plentiful use has been made of illustrations and diagrams designed to indicate principles rather than particular types of equipment or apparatus.

The work can be thoroughly recommended to all those who would acquire an understanding of the applications of electronic and associated phenomena to science and industry.

Electrical Engineering Practice. Fourth Edition. Vol. III. By J. W. Meares and R. E. Neale. Pp. 920; figs. 426. London: Chapman & Hall. Price 30s.

The fourth edition, revised and enlarged, of this important work is now completed by the appearance of this third and final volume, which contains an index to the whole work of more than 2,000 pages. There is no other British publication in the whole field of electrical engineering literature which is properly comparable to this production. It can be fairly described as giving the practical information which a reader often fails to find in text-books, together with the development and explanation of a subject outside the scope of pocket-books.

In this volume the electric motor holds the principal place and receives a very thorough treatment. It is characteristic of the method consistently adopted by the authors of commencing at the beginning of a subject, that the chapter entitled "Electric Motors" which concludes with an extensive bibliography and three pages of approximate price-lists of all types of motors and motor starters, starts off with an account of the general principles of d.c. electric motors and an explanation of their characteristics. Similarly for a.c. motors, vector diagrams of their action can be studied together with their commercial characteristics and applications.

The discussion of control and protection of motors includes practically all types of gear that are met with in practice; automatic starters, however, do not receive that prominence which their importance might justify. With regard to electric driving an immense amount of data and information is given. In this and in succeeding chapters on specific applications there are but few aspects of electric drive which do not receive attention. The most recent practice in many important industries is described, and under the chapter-headings of electric hoisting and conveying, electricity in mines, agriculture, traction, road vehicles, propulsion of ships, industrial processes—chemical and metallurgical, will be found satisfying accounts of electrical practice. A good deal of this information has not been readily accessible hitherto in convenient form and both students and electrical engineers who cannot possibly be fully conversant with every aspect of their profession should be glad of these most helpful chapters. Concluding sections are devoted to specifications referring to generators, transformers, cables, prime movers, etc.; depreciation and maintenance; testing of instruments, machines, lines and high voltage insulators.

Finally a summary of the law relating to electricity supply, and statutory and other regulations and rules are given.

* * *

Shorter Notices

"Every Boy's Book of Electricity," by R. Barnard Way. Pp. 105; illus. London: Percival Marshall. Price 1s. This little book is a simply written introduction to the first principles of electricity and electrical appliances. Excellent diagrams have been included.

"The Complete Projectionist," by R. Howard Cricks. London: Kinematograph Publications. Price 5s.

"Electrical Circuits and Machinery," by J. H. Morecroft and Frederick W. Hehre. Vol. II. Alternating Currents. London: Chapman & Hall. Price 28s.

The thirty-sixth annual edition of "Garcke's Manual" (Electrical Press, 35s.), containing 2,000 pages and twenty maps, is now available. The manual is unique in its wide scope, and contains financial, technical, commercial, and general information regarding over 5,000 electrical undertakings, as well as a directory of electrical companies and 17,000 officials.

"Railway Track-circuits," by D. C. Gall. London: Sir Isaac Pitman & Sons. Price 7s. 6d.

"Electrical Technology," by W. L. Horwood. London: Griffin & Co. Price 10s. 6d.

The Quasi-Arc Co., Ltd., has issued the second cloth-bound volume of "Electric Welding." This contains the issues for the period October, 1932, to August, 1933.

Materials for the Electrical Industry. By L. H. Quin

The course of the markets in 1933

Copper

THE outstanding feature of the copper market during the past year—the first after the break-up of Copper Exporters, Inc.—was, of course, the marked revival in American consumption, especially between April and July. This followed President Roosevelt's strong "recovery" drive, and, since domestic production was kept down to about 20 per cent. of capacity, resulted in the surplus stocks there of refined copper being reduced by over 100,000 short tons, although they are still more than 500,000 tons.

In the rest of the world there was also an appreciable improvement in consumption, especially in this country, where, under the protection of the tariff, copper-manufacturing concerns have become busily employed. So far as the electrical trade here is concerned, activity seems to have been most marked in the lighter types of wiring and appliances, demand for underground and heavy cables being small, whilst in the grid (mainly overhead lines) aluminium was used far more extensively than copper.

The increase in consumption outside the United States was accompanied by a growth in production, especially in Africa and Canada, the potential output of low-cost copper from these countries being large. Since most of the world's surplus copper is stored in the United States there have not been important changes in the European stock position, the reserves being only moderate.

The price of the metal improved fairly consistently until July, when the highest level of the year (£39 for standard) was reached. Subsequently quotations reacted rather sharply owing partly to less enthusiasm regarding the Roosevelt administration's experiments, but more particularly owing to the depreciation in the American and Canadian dollars, which enabled producers there to sell cheaply abroad without decreasing their net return in their own currencies. The actual tonnages thus sold were not unduly large, but supply and demand outside the United States are rather precariously balanced, and it does not require very substantial quantities of metal to upset prices.

The year closed on a fairly hopeful note, however, and it is generally conceded that at the current level of prices copper is cheap; and provided expectations of rather better trade next year are not falsified a moderate improvement in prices appears probable. No marked rise seems justified, however, until consumption is appreciably larger than it is to-day, and the gap between demand and potential supply is considerably narrowed.

Lead

Viewed broadly, the lead market was disappointing during 1933. World stocks, which were heavy at the beginning of the year, appear to have been reduced hardly at all on balance, while in the early months the trend was upwards. Undoubtedly the weakest section has been the cable industry. Practically all over the world activity in the manufacture and laying of lead-covered cables has been much below the level which had come to be regarded as the post-war "normal," and the widespread adoption of overhead transmission lines has made it doubtful whether lead-covered cables will return to anything like their 1926-1929 position for a considerable time.

In this country other lead-consuming trades have been pretty active, notably pipes and sheets, although battery makers, especially towards the end of the year, reported a substantial improvement in business. This was accounted for partly by the continued popularity of battery wireless sets, and partly by the good demand for motor-cars which followed the annual Motor Show in the autumn. In addition, some good contracts for batteries for submarines were executed by some of the manufacturers.

Lead prices have been rather unsatisfactory throughout the year, although, as with other metals, an improvement was seen in the summer. The peak figure, however, was under £14. At the present time production and consumption appear tolerably well balanced, but if silver is to become more valuable as a result of the London Silver Agreement it may stimulate lead production, since the two metals are always found together.

Prospects for 1934 appear only moderately hopeful, since, although some expansion in general trade is looked for, there is still a great deal of surplus lead about, world stocks being estimated at around half a million tons. Until this total is reduced, there seems little justification for more than a moderate improvement in lead prices, since in Canada, Australia and Spain, at any rate, producers are getting a higher return than is indicated by the London prices, owing to depreciated exchanges. The United States, of course, is a purely self-contained market so far as lead is concerned.

Aluminium

It is no longer possible to ignore aluminium when discussing materials used in the electrical trades. The fact that the national grid in this country alone absorbed some 12,000 tons of aluminium for cables and other equipment is clearly proof of this. Aluminium prices have been pegged throughout the year, and look like remaining so for some time to come. Productive capacity is well ahead of current consumption, but demand latterly has been improving somewhat, and the unified selling policy of the aluminium producers of the world has enabled surplus stocks to be reduced to quite manageable proportions.

Rubber

The outstanding feature of the rubber market in 1933 was, of course, the close attention paid by producing countries to the question of restricting output. Nothing definite was done, but it is felt that many difficulties have been disposed of, and the general opinion is that restriction will come—possibly within the next twelve months.

During the past year consumption outside America showed a marked recovery, whilst in the United States, after a slow start, an expansion was also seen. Production was stimulated, however, especially as regards native rubber, and, on balance, world stocks look like being 15,000 tons higher on the year, although world consumption is estimated at 800,000 tons, compared with about only 685,000 tons in 1932. The price at the end of the year of just over 4¼d. per lb. was not far short of the highest figure reached, but this was admittedly very unsatisfactory to producers, conditions on many estates reflecting the extreme economies which have had to be exercised in order to keep going.

There seems quite a chance of consumption showing further expansion during the coming year, and if restriction of output is also introduced prices may move to an appreciably higher level. Everything hinges upon the question of restriction, however, which, as recent discussions have illustrated, remains a very difficult matter upon which to secure universal agreement.

Municipal Transport Undertakings' Results, 1932-33

District	Engineer or Manager.	Total Revenue.		Working Expenditure.		Net Profit or Loss.		Car Miles Run.		Passengers Carried.	
		1931/32.	1932/33.	1931/2.	1932/3.	1931/32.	1932/33.	1931/32.	1932/33.	1931/32.	1932/33.
		£	£	£	£	£	£				
Barking	W. E. Kidner ...	—	2,993	—	376	—	— 1,961	—	—	—	—
Brighton	W. Marsh	131,574	126,103	104,284	104,811	+ 9,260	+ 6,087	1,922,314	1,911,503	25,091,139	23,107,497
Burnley	C. H. Stafford ...	132,964	92,862	110,214	77,368	+ 5,683	+ 2,631	1,871,413	1,365,765	19,726,921	13,779,409
Colne	J. H. Thompson ...	14,916	13,577	12,776	11,878	— 6,942	— 7,204	169,328	169,377	2,442,468	2,292,812
East Ham... ...	W. R. Elliott ...	115,237	109,258	100,105	101,897	— 10,712	— 16,260	1,955,261	1,961,503	21,699,485	21,324,456
Erith	J. C. Williams ...	—	21,719	—	25,581	—	— 7,166	—	—	—	—
Heywood	H. C. Day	12,532	3,377	12,609	4,210	—	— 2,008	231,310	54,867	1,831,260	496,185
Ipswich*	H. E. Blackiston ...	71,690	70,918	57,049	55,650	+ 362	+ 660	1,468,963	1,522,395	12,861,271	12,676,547
Liverpool	C. G. Jackson ...	1,360,408	1,307,109	1,161,128	1,093,206	+120,649	+126,877	20,242,871	19,717,231	250,987,887	240,421,392
Manchester ...	R. Stuart Pilcher ...	1,508,621	1,427,252	1,242,193	1,153,814	+ 25,245	+ 48,665	20,353,800	19,934,203	269,559,417	248,518,259
Nelson	T. Dawson Martin...	—	—	—	—	—	—	204,219	184,963	2,909,681	2,577,033
Newport (Mon.) ...	A. Nichols Moore ...	54,020	51,287	47,731	44,733	— 4,617	— 11,239	902,859	895,166	7,895,607	7,776,044
Oldham	J. F. Richards ...	171,681	157,767	137,327	131,249	+ 4,242	+ 8,586	2,433,734	2,373,519	28,219,545	26,639,825
Southport ...	T. J. Kendrew ...	47,055	38,813	37,320	30,632	+ 6,096	+ 7,508	821,419	719,603	9,096,833	7,563,267
Sunderland ...	C. A. Hopkins ...	116,192	115,157	82,742	81,818	+ 23,511	+ 24,343	1,665,305	1,729,367	27,504,022	27,165,857
Wolverhampton ...	C. Owen Silvers ...	183,904	212,899	117,753	134,149	+ 8,312†	+ 8,816†	2,732,286	3,383,277	25,956,916	29,127,599

* Tramways and trolley-buses. † Including motor omnibuses.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Ferguson, Pailin's Progress

The more important work nearing completion by Messrs. Ferguson, Pailin, Ltd., includes circuit-breakers of higher rupturing capacity for existing switchgear of all types due to increased fault kVA. The rupturing capacity has been increased in many instances by fitting a cross-jet explosion-pot arc-control device, which has now been proved up to 4,000 A and 1,000,000 kVA. Work is in hand on the second portion of the 33-kV oil-filled 750,000-kVA main switchboard for the Tir John power station of Swansea Corporation, the switchgear ordered by the C.E.B. having been completed, as has also the 6.6-kV 1,000,000-kVA main switchboard for Stepney with twenty 4,000-A panels with cross-jet explosion pots. A nineteen panel 6.6-kV board is being manufactured for Edward Lloyd's paper mills with 500,000-kVA cross-jet explosion pot breakers, and l.v. auxiliary switchgear.

A number of orders are also in hand from three foreign countries as well as from the overseas Dominions. Notable installations completed during the year include 132-kV switchgear and 33-kV, 750,000-kVA compound-filled gear for indoor sub-stations at Padiham and Burnley for the N.W. England grid, and two single circuit-breaker sub-stations for the S.W. England scheme. In the S.E. England area 33-kV, 500,000-kVA metal-clad switchgear has been supplied for an outdoor single-switch sub-station, with provision for change to a three-switch sub-station. The circuit-breakers are fitted with cross-jet explosion pots and are filled with thin transformer oil. The most important orders for industry relate to the supplies for the grid to J. & P. Coats' Ferguslie Mills (15,000 kVA) and Anchor Mills (8,000 kVA) at Paisley; these are controlled by 6,000 and 5,000-A switchgear with a rupturing capacity of 800,000 kVA at 500 V ordered by the C.E.B.

The lighting of the church of Notre Dame des Vallées

Electrical Trade in the Midlands

The outlook for the electrical industry in Birmingham and the Midlands is promising, particularly with regard to the accessory branches and domestic equipment. Trade this season both on home and export account is progressive, and business is expanding very well in the Empire markets, and particularly in South Africa. In the heavy power machinery department trade continues quiet, although lately there has been a better volume of inquiries from overseas.

E.D.A. Activities

Particulars and illustrations are given in the January programme of the British Electrical Development Association of supplementary services which it has introduced to assist members in preparing their programmes of local publicity and advertising for 1934. These include designs for overprinting envelopes, delivery van signs, trench boards, book matches, posters, &c. The Association will shortly be nationally advertising electric water heating and cooking and the suggested window display for the month deals with water heating. The price list of literature includes heating, lighting and cooking matter.

Following the large number of requests made at the last of Mr. Elliott Stone's three lectures on public speaking, the British Electrical Development Association is arranging further opportunities for practice in public speaking on January 17th and 31st. At these meetings members of the audience will be invited to give short speeches in reply to questions to be put by Mr. Stone. Mr. Stone will afterwards offer advice and suggestions as to how the speeches could be improved. Members of the electrical industry, particularly those employed by supply undertakings as salesmen or demonstrators, are invited to attend the meetings, further particulars of which may be obtained on application to the Association at 2, Savoy Hill, W.C.2.

Wimbledon Showrooms

The official opening of the new electricity showrooms of the Wimbledon Corporation takes place on January 25th in the afternoon.

The Weymouth Electricity Showrooms

With regard to the notes published in our last issue relating to the new showrooms of the Weymouth and Melcombe Regis electricity undertaking, we are informed that the electrical installation was carried out under the supervision of Mr. G. Nicolson, the borough electrical engineer.

A French Church-lighting Installation

A departure from ordinary church lighting is to be seen in a new church recently constructed by Monsieur Chailleux, at Colombes, France. Notre Dame des Vallées demonstrates that much can be done with modernised Gothic architecture. Great care has been taken with the nave and the aisles. All lighting is indirect, the choir and the aisles having 200-W lamps with silvered glass reflectors. The nave has 500-W lamps, while the altar is illuminated by small floodlight projectors.

Economic Conditions in Sweden

The Commercial Counsellor at Stockholm has prepared a report for the Department of Overseas Trade on economic conditions in Sweden. In this he states that Swedish iron and steel production during 1933 was at a higher level than in the preceding year. Many machine makers reported better employment than in 1932, and there were indications of a slight improvement in the electrical industry. An important stage in the process of the electrification of the main railway lines of Sweden was reached early in October, when the work of converting the railway between Stockholm and Malmö was completed. Full electric working on this line, which will shorten the Continental connection of Stockholm, will not, however, take effect until early in 1934. Dealing with the prospects of British trade with Sweden, the report states that in Sweden the average consumer finds himself obliged to curtail his expenditure, and is now inclined to turn from goods of high quality, for which Great Britain has always enjoyed a reputation in Sweden, to cheaper articles produced in the country under the protection of the tariff and a slightly depreciated currency. On the other hand, the exporting producers and manufacturers are anxious, even with some increase of cost, to keep on good terms with their best customer, and to buy as much as possible from Great Britain.

Recent Contracts

In connection with the large extensions which are now being made to Messrs. Edward Lloyd's Kemsley paper mill, the English Electric Co., Ltd., has received a contract for three turbo-alternator sets comprising: (1) A 15,000-kW, two-cylinder, 3,000-r.p.m. pass-out turbine, believed to be the largest machine of this type yet constructed in this country. It will generate power and supply process steam up to 240,000 lb. of steam per hour at a pressure of 20-30 lb. per sq. in. gauge to the largest newsprint machine in course of construction. The alternator will generate power at 6,600 V, 50 cycles, three phase. (2) A 5,000-kW pass-out single-cylinder turbine at 3,000 r.p.m. to pass out up to 150,000 lb. of steam per hour, at a pressure of 20-30 lb. per sq. in. gauge. The alternator will generate power at 6,600 V, 50 cycles, three phase. (3) A 750-kW single-cylinder geared house set, running at 7,000 r.p.m., the alternator being geared down to 1,500 r.p.m. and generating power at 430 V, 50 cycles, three phase.

The company has also been awarded a contract for mercury-arc rectifiers by the L.M. & S. Railway Co. This installation will replace equipment that has given electricity supply to St. Pancras railway station and the hotel for over thirty-five years. The equipment will consist of three 200-kW units, each comprising two six-phase glass-bulb rectifiers with the

necessary transformers and auxiliary equipment. The supply is 11,000 V, three-phase, 25 cycles, and the pressure on the d.c. side is nominally 230 V. A feature of this installation is that grid control will be provided to allow for a 10 per cent. variation in the a.c. supply pressure and also to give an adjustable compounding effect of 5 per cent. The contract also includes four 75-kW equipments, without grid control, for converting an 11,000-V, three-phase, 25-cycle supply to d.c. at 230 V. These equipments will be installed, two each, at the Kentish Town and St. Pancras goods sub-stations. The company has orders for rectifiers for two of the other railway groups. For the L. & N.E. Railway Co. two 300-kW glass-bulb equipments are being supplied for Parkstone Quay; the supply is 6,000 V, three-phase, 50 cycles, and the d.c. pressure is 440 V. Grid control is not provided, but an arrangement is made by means of contactor gear to enable bulbs to be switched in and out depending on the load.

The Great Western Railway Co. has also placed a contract with the company for a 450-kW glass-bulb rectifier installation to replace existing steam-driven d.c. generators installed at Fishguard Harbour. Supply will be taken at 11,000 V, three-phase, 50 cycles, and the rectifiers will be arranged to give a three-wire d.c. supply at a pressure of 2 × 250 V. Grid-control provides for voltage variation from 220 to 250 V by manual control.

It is reported that Messrs. Babcock & Wilcox, Ltd., have received orders of a total value of about £750,000. It is stated that these orders will provide constant employment for the Renfrew works until late in the year, and the re-engagement of many employés who have been suspended.

The Portsmouth Corporation has decided to replace its tramcars by electric trolley buses, and has recently accepted tenders for the supply of both four- and six-wheel double-deck vehicles. Four "Sunbeam" trolley buses have been ordered, two vehicles on "Sunbeam" four-wheel "M.F.2" chassis, each seating fifty passengers, and two six-wheel vehicles on the new "M.S.3" chassis, each seating sixty passengers. The "M.S.3" chassis has a new type of frame, which gives a low loading and low floor height for the lower saloon, and the offset mounting of the motor and transmission. This type of chassis is also used for the double-deck trolley buses which the Sunbeam Motor Car Co. is supplying to the Wolverhampton Corporation. These vehicles will be in service early in the New Year.

The Argentine Government placed an order last May with the Anglo-Argentine General Electric Co., Ltd., for four "Gecophone" "Overseas" receivers for use in its broadcast control. These having proved satisfactory, the Government has placed an order with the company for further sets. The "Overseas" model is designed for A.C. operation and for short- and medium-wave reception.

"The Wizard in the Wall"

The accompanying illustration shows a mechanical adaptation of the familiar E.D.A. design, "The Wizard in the

A mechanical "Wizard in the Wall"

Wall," which Mr. M. Randell-Clark, consumers' engineer to the Weston-super-Mare & District Electric Supply Co., Ltd., has constructed for use in the windows of the company's showrooms. The hand, which is life-size, moves up and down, operating the switch, with a suitable pause in the "on" and "off" positions. This switch controls window lights or other display with very effective results.

Calendars, Diaries, &c.

The desk calendar from Messrs. B. S. & W. Whiteley, Ltd., has daily slips, with quotations from the classics.

The wall calendar of Messrs. Craven Brothers (Manchester), Ltd., has large sheets showing the preceding, current, and following months, with illustrations of the company's products.

Representatives of the Central Electricity Board at the showrooms of the Aylesbury Electricity Department

Front row (left to right): Ald. J. Robinson, Sir Archibald Page, Major Caldwell, Sir Andrew Duncan, the Mayor of Aylesbury (Coun. G. Gargini), Coun. A. E. Ecob (chairman of the Electricity Committee), Mr. W. A. Turnbull (borough electrical engineer), and Mr. A. Logan (sales superintendent). *Back row:* Messrs. H. Hobson (C.E.B.), S. J. Watson (C.E.B.), H. Crookes (Town Clerk), Ald. A. Rose, and Coun. E. S. Mackrill.

"No Trespassing," a meeting of two prospectors with a grizzly bear in the Canadian Rockies, makes a thrilling picture for the calendar of Messrs. Norvall Bros., Ltd., which has monthly slips.

Daily slips form the calendar of Messrs. Barrett, Tagant & Gotts, Ltd., which is also provided with space for recording engagements.

An illustration of its cooling towers surmounts the calendar of the Davenport Engineering Co., Ltd., which has daily slips.

Mr. Geo. Barnard has sent us a desk calendar in a strong leather frame with a magnetised indicator, and a neat diary bound in imitation crocodile leather.

The calendar of Messrs. E. N. Mason & Sons, Ltd., has large monthly sheets with the following three months given in smaller type.

Illustrations of the company's products head the monthly sheets of the calendar received from Dexine, Ltd.

The calendar of Pope's Electric Lamp Co., Ltd., has monthly sheets with large figuring.

The calendar of the Revo Electrical Co., Ltd., has large daily slips surmounted by a picture of the company's works at Tipton.

"Over the Sea to Skye" is the title of an excellent seascape picture chosen for the calendar of the Hart Accumulator Co., Ltd.

The calendar of Messrs. Lionel Robinson & Co., Ltd., which has monthly slips, bears an excellent etching of 3, Staple Inn, W.C.

Some well-executed wash-drawings of historic places in Switzerland illustrate the 1934 calendar of British Brown-Boveri, Ltd.

Messrs. G. & T. Earle, Ltd., have sent us their wall calendar for the years 1934-36 inclusive. This has large monthly sheets.

"Enid," a photo etching from life of a charming maiden, adorns the calendar of the Concordia Electric Safety Lamp Co., Ltd.

Large monthly sheets form the calendar of Brittain's Electric Motors (formerly Langdon-Davies).

The Lytham-St.-Anne's Corporation Electricity Department has issued two coloured wall calendars, "The Minstrel Boy" and "Loading the Nets," which are sure to be popular among consumers.

Trade Announcements

Ensign Lamps, Ltd., has opened a London depôt at 67-75, Broadway Chambers, Ludgate Hill, E.C.4, under the management of Mr. J. F. Young.

The Skefko Ball Bearing Co., Ltd., has opened a new stock and service depôt at 31, Mosley Street, Newcastle-on-Tyne. Telegrams: "Skefko," Newcastle-on-Tyne. Telephone: Newcastle 23736. Mr. J. E. Potts is the local representative.

The Dominion Electrical Co. has removed to 31, Windmill Street, Tottenham Court Road, W.1. (Telephone: Museum 4220.)

For Sale

The Ilkley Electricity Department has for sale a 250-kW rotary convertor, two motor alternators, various d.c. motors and meters.

The West Cambrian Power Co., Ltd., has for disposal a horizontal twin-cylinder, 150-b.h.p. "Tangye" gas engine.

(See our classified advertisements.)

The Dairy Exhibition

At the National Dairy and Ice Cream Exhibition, which is being held at Olympia, London, this week, perhaps the most interesting class of exhibits from the electrical point of view is refrigeration equipment, for apart from actual ice cream freezers, British Automatic Refrigerators, Ltd., Frigidaire,

Ltd., General Utility Co., Ltd., J. & E. Hall, Ltd., Kelvinator, Ltd., the Lightfoot Refrigeration Co., Ltd., Marco Refrigerators, Ltd., E. West & Benyon, Ltd., and Electrolux, Ltd., are all showing comprehensive ranges of food-storage cabinets. A 50-gal. per hour milk-cooling equipment seen among the Lightfoot exhibits is served by a 1½-h.p. motor-driven compressor and is one of many of its kind on show generally, including those displayed by the Creamery Package Manufacturing Co., Ltd., the Graham Enock Manufacturing Co., Ltd., and the Pulsometer Engineering Co., Ltd. The driving motor of a small self-contained cooling plant display by the U.D. Engineering Co., Ltd., operates automatically, and a three-cylinder 800,000 B.th.u. per hour ammonia compressor is another feature of this company's display. Bottle-washing apparatus varies in size from small single-brush units with direct motor drives, such as one displayed by the Dairy Outfit Co., Ltd., to large conveyor-type equipments with capacities of several thousand bottles per hour such as one which we saw displayed by the British Miller Hydro Co., Ltd., which is served by only two small motors. Other dairy equipment on show—bottle-filling and capping machines, pasteurisers, &c.—closely resembles that at the recent Dairy Show, the electrical exhibits of which we reviewed at the time.

Persian Import Quotas

H.M. Representative at Tehran reports that quotas have now been fixed for the importation of certain goods into Persia for the year 1933-34, previously classed as prohibited. According to the *Board of Trade Journal*, these include "electric utensils," the quota for which is 500,000 rials (rial = $28.28).

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, January 3rd.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash Chlorate ... ... per lb.	3½d. to 4½d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£3	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. less 6 per cent.	—
METALS, ETC		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/2 to 2/9	—
p Babbits' Metal and Anti friction Metals—		
Grade I ... ... per ton net	£205	—
Grade II ... ... ,,	£141	—
Grade III ... ... ,,	£69	—
c Brass (rolled metal 2" to 12" basis) per lb.	7d.	—
c ,, Tubes (solid drawn) ... ... ,,	9d. to 9½d.	—
c ,, Wire, basis ... ... ,,	7½d.	—
c Copper Tubes (solid drawn) ... ,,	10d.	—
g ,, Bars (best selected)... ... per ton	£62	—
g ,, Sheet... ... ... ,,		—
g ,, Rod ... ... ,,		—
d ,, (Electrolytic) Bars ... ... ,,	£44 10s.	—
d ,, ,, Sheets ... ,,	£64	—
d ,, ,, Wire Rods ... ,,	£44 10s.	—
d ,, ,, H.C. Wire ... per lb.	7¼d.	—
f Ebonite Rod ... ... ,,	1/3 to 1/6	—
f ,, Sheet ... ... ,,	1/3 to 1/6	—
n German Silver Wire ... ... ,,	2/2	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	4½d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual. ,,	£20	—
g Lead, English Pig ... ... ,,	£12 10s.	5s. dec.
g Mercury ... ... per bot.	£9 10s. to £9 15s.	—
e Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11d.	—
p ,, ,, rolled strip & sheet ,,	11d.	—
p ,, ,, wire ... ... ,,	11¾d.	¼d. inc.
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	8 5/8d.	—
r Steel, magnet, in bars ... ... ,,	7¼d.	—
n Tin, Block (English)... ... ... pet ton	£227 15s. to £229 15s.	15s. dec.
g ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. R. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notices" under the same heading.

Social Events

The staffs of the various branches of Nulite Fittings, Ltd., were entertained to tea by the directors at the company's showroom, Watling Street, Manchester, on Boxing Day. About sixty members of the managerial, representative and clerical staff were present. During the speeches, mention was made of the rapid progress of the company, whose practice it had been to open several new shops each year. Mr. S. Phillips, the managing director, thanked the staff for their co-operation during the past year. Mr. Robinson (Leeds branch manager) responded.

A happy gathering at a children's party given on December 23rd by the Bruce Peebles Employés' Social and Sports Club, in the works canteen hall

The Athletic, Recreation and Social Club of Messrs. J. H. Tucker & Co., Ltd., held a dinner, dance and social on December 21st, at the Market Hotel, Birmingham. In responding to the toast of "The Firm," the managing director, Mr. J. B. Tucker, said it was gratifying to all to see in common with the electrical trade generally the decided increase in the amount of business done by Tucker's during recent months. A variety concert, followed by dancing, occupied the remainder of the evening.

A company of 150 attended on December 22nd at the annual whist drive, dinner, and dance of the Aberdeen branch of the Electrical Contractors of Scotland. Mr. Walker, president of the branch, presided, and the company included Mr. D. Bennet, president of the Electrical Contractors' Association of Scotland, Messrs. A. Lindsay, R. A. Ure, J. Allan, P. J. Sims, W. Findlay, D. Pratt, H. Tait, D. Morris, R. Kilpatrick, E. Hood (Electrical Development Assoc.), R. McAllister, and W. Yuille. Mr. J. Bell proposed the toast of the guests, and Mr. G. S. Fraser, town clerk, and Mr. D. Bennet replied.

Catalogues Wanted

Messrs. L. Clarke & Co., Ltd., Acme Works, King Street, Southall, Middlesex, ask for catalogues and lists, &c., of weeding materials and plant.

Deferred Australian Duties

The Australian Commonwealth Government has postponed until July 1st next the deferred duties on certain goods which were to operate from January 1st, 1934. These include electric household dish-washing machines.

Lighting in Collieries

The Board of Trade has made new regulations under the Coal Mines Act, 1911, and the Mining Industry Act, 1920. Under their provisions safety lamps at the working face, rippings, or any other places where tubs are filled shall be of a type marked as approved by the Board of Trade to give, at the end of nine hours' continuous burning under standard test conditions, minimum m.s. c.p. of 0.4 for cap-lamps, and 0.75 for other types, with a mean c.p. over the horizontal angle of distribution of 1.5. The light must not cause glare or marked contrasts of light and shade within the area of distribution. The standard test of new safety lamps, to be determined by the Board of Trade, shall include the use of a bulb appropriate to rated voltage, ampères, and efficiency. For testing the maintenance of lighting efficiency during service, electric lamps shall be wiped clean and the accumulator recharged; the lamp will be tested with a bulb of the same rated voltage, ampères, and efficiency as that used for the test of new lamps, and the m.s. c.p. shall not be less than 25 per cent. of that of the new lamps. Each type of safety lamp shall have an approved bulb appropriate to the rated voltage, ampères, and efficiency.

Electricity from a source external to the lighting unit may be used: (*a*) on roads ventilated by intake air, but, except as provided below, not within 300 yards of a working face; (*b*) on main return airways within 300 yards of an upcast shaft used regularly for winding, but, except as provided below, not within 300 yards of a working face; (*c*) on roads ventilated by intake air except within 50 yards, and on other roads except within 100 yards of a working face (1) in any ventilated district in which electric power is used at a working face, and (2) in any other ventilated district with the

written permission of the Inspector of the division; and (3) in any other place allowed by special regulation. For new lighting circuits not extending to places covered by (*a*) and (*b*) above, the voltage of the external source of electricity shall not exceed 125 V, and the neutral point shall be earthed. The bulb of a lamp supplied from an external source shall be hermetically sealed and enclosed in a substantial protective fitting, and all lighting apparatus shall be of a type approved by the Board of Trade, except that installed in any place covered by (*a*) or (*b*) above. Sufficient and suitable lighting shall be maintained at shaft insets and sidings and in every place above-ground where persons regularly work or pass.

New Catalogues and Lists

S. O. Bowker, Ltd., Regent Row, Birmingham.—The 1934 catalogue of the "Tenby" wiring system, including a supplement dealing with the "Tenbyluxe" switch.

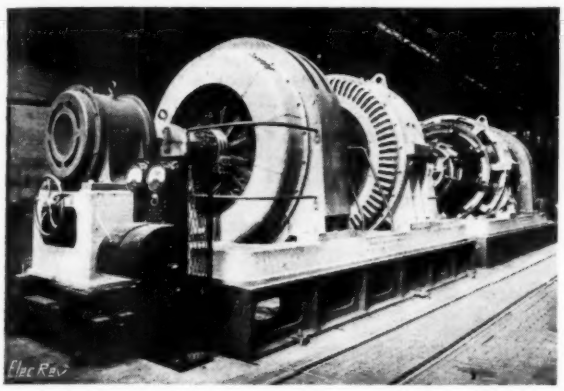
Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.—Publication 6807 relating to push-button starters for d.c. motors.

F. Hulme & Co., Ltd., 78, George Street, Manchester.—A price list of conduits.

Telegraph Condenser Co., Ltd., Wales Farm Road, W.3.—A leaflet describing the new "T.C.C." anti-interference unit.

Bruce Peebles & Co., Ltd., Edinburgh.—Specification No. 70, covering a complete range of industrial type a.c. motors.

Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.—A new publication illustrating and describing the Brush "N.S." type salient pole alternator.



Two large motor-convertors supplied by the Brush Electrical Engineering Co., Ltd., to the Luton Corporation. They are rated at 2,500 kW, 500/550 V d.c. and 6,000/6,600 V a.c., three-phase, 50 cycles (500 r.p.m.).

British Aluminium Co., Ltd., Adelaide House, King William Street, E.C.4.—A well-produced booklet containing some excellent illustrations in sepia showing some architectural uses of aluminium and its light alloys.

J. G. Smithson & Co., Ltd., Nelson House, Moor Street, Birmingham.—A pamphlet illustrating and describing a patent automatic voltage regulator.

Bankruptcy Proceedings

W. E. Debrunner, wireless dealer, lately carrying on business at 118, Southwark Street, S.E.—The statutory first meeting of creditors was held last week at London Bankruptcy Buildings. According to the debtor's statements he started a mail-order business in 1927, selling wireless valves and taking offices at Paternoster Square, E.C. In August, 1930, he formed P. R. Products, Ltd., and in 1932 a receiver was appointed on behalf of the debenture holders. The British Pix Co., Ltd., was formed in January, 1931, to manufacture and market the Pix patents. Premises were taken at 118, Southwark Street, and the debtor was appointed managing director of the company. In April, 1931, a large number of imitations of the company's goods, to the extent of £10,000, were placed on the market at cut prices. The debtor roughly estimates his liabilities at £4,000, they being almost entirely for guarantees given by him on behalf of P. R. Products, Ltd., and the British Pix Co., Ltd. In the absence of assets the case was left in the hands of the Official Receiver.

S. C. d'Este, radio dealer, lately of The Broadway, Wood Green, and Station Road, Finsbury Park, N.—This debtor attended on December 20th at the London Bankruptcy Court and passed his public examination upon accounts showing liabilities of £376 against assets of £6. He stated that he began business in August, 1929, with £50 capital, dealing mainly in radio and electrical goods. He called on shops in and around London and sold stock both on credit terms and for cash. In May, 1933, realising his position, he closed his business and had since been without regular occupation. He attributed his insolvency to lack of capital, bad trade, insufficiency of profits to meet overhead expenses and drawings, and to cost of repairs to his car following accidents. The examination was concluded.

R. F. Palmer, 19, Church Street, Burnley, Lancs, electrical engineer.—This debtor's public examination was held recently at the County Court House, Burnley. The statement of affairs showed ranking liabilities of £374 and an estimated deficiency of £372. In 1921 debtor commenced business as an electrical engineer at Burnley, with a capital of between £80 and £90. The business consisted of installing electricity in cotton mills, and gradually developed until debtor was employing six people. In 1927 the business was removed to 18, Church Street, and debtor continued successfully until 1929. About that time several mills closed, and consequently debtor received fewer orders. Since early in 1931 creditors had pressed and he had had considerable expense in connection with his wife's illness. The failure was attributed to insufficient turnover. The examination was adjourned for closing.

C. J. Mount, "White House," East Acton Lane, W.3, electrical contractor.—The public examination herein was held recently, at the Court House, Brentford, when the statement of affairs showed liabilities of £644 and assets of £128, leaving a deficiency of £516. Debtor attributed his position to loss on certain contracts, depression in trade, and ill-health. The examination was adjourned for closing.

W. H. Tweedle (Premier Radio & Electrical Supplies), radio engineer and dealer, Paddock Head, Paddock, Huddersfield.—Receiving order made December 21st on debtor's own petition.

H. P. Baker (M. H. Baker & Son), electrical contractor, 9, Station Road, Walthamstow, Essex.—First meeting January 8th, and public examination March 7th, both at Bankruptcy Buildings, Carey Street, W.C.

D. W. Morphy, manufacturer of wireless apparatus, 14, Collinette Road, Putney, S.W.—Trustee, Mr. E. Parke, Bankruptcy Buildings, Carey Street, W.C., Official Receiver, released December 5th.

A. C. Clewley (Radioland), electrical goods factor, 21, Portland Street, Walsall.—Trustee, Mr. C. Hoult, 159, Great Charles Street, Birmingham, Official Receiver, released December 8th.

Company Liquidations

Electric Winding & Doubling Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. Harrop, 10, Norfolk Street, Manchester. Particulars of claims by February 5th to the liquidator.

Ross Electric Light & Power Co., Ltd.—Meeting January 30th at Aldwych House, Aldwych, W.C., to receive an account of the winding-up by the liquidator, Mr. J. E. Birchall.

Mechanical & Electrical Engineering Co. (Birmingham), Ltd.—Meetings January 31st at 12, Cherry Street, Birmingham, to receive an account of the winding-up by the liquidator, Mr. W. Hand.

Australian Tariffs on Electrical Equipment

SEVERAL inquiries are being held by the Australian Tariff Board into duties on electrical machinery and appliances. Regarding electricity meters, the inquiry is into the necessity for the rates of duty imposed by the Customs Tariff Bill, 1933. Under this the British preferential rate is 10s., or 35 per cent. *ad valorem* (whichever is the greater), and the general tariff is 15s., or 55 per cent.

Mr. Bertram Montgomery, as the representative of the British Sangamo Co., Ltd., London, and of Warburton, Franki, Ltd., an Australian electrical engineering firm, said that Australia was one of the worst metered countries in the world. The cost of all electricity undertakings was considerably increased through high duties compelling supply authorities to purchase from one local manufacturing firm, which had a monopoly. The prices at which supply authorities throughout Australia were compelled to purchase these meters was unreasonable, considering the f.o.b. or c.i.f. values of imported equipment.

He considered that the Australian industry should now be firmly established and in a position to compete at a lower rate of duty. It had had a monopoly for nine years, as the 10s. rate of duty was imposed in 1925. Owing to these duties the electricity supply authorities were compelled to use out-of-date 1920 model meters of local manufacture. These were still being produced and there was not the same incentive to improve this model while there was no competition.

Mr. Montgomery asked for the duty on British meters to be reduced to 20 per cent. *ad valorem* and the general rate to 40 per cent., and for the fixed rates to be cancelled. Mr. Ernest Bate, electrical engineer to the Victoria Electricity Commission, said the restriction of competition was unfavourable to the electricity supply undertakings.

Generators and Transformers

At the inquiries into the duties on generators and transformers, Mr. I. V. Robinson, representative of the B.E.A.M.A., gave evidence. He said that the Council of his Association was of opinion that the British preferential duty of 33.75 per cent. on these machines should be reduced to 15 per cent. He quoted figures to show that as a result of the duty the price of English generators in Australia, exclusive of exchange, was higher by 69 per cent. than the price of similar articles delivered f.o.b. at a port in the United Kingdom. Allowing for the present exchange rate, the excess cost over the f.o.b. price at a United Kingdom port was 97.3 per cent.

In his opinion the average cost of materials used in Australia for the construction of transformers would exceed the corresponding cost in the United Kingdom by 51.2 per cent. Under the Ottawa agreement the Australian Government undertook that protection by tariffs was only to be given to industries which were reasonably assured of success. Replying to a question, Mr. Robinson said that Swedish manufacturers carried on a kind of guerilla warfare in the British Empire, and depended on the Swedish markets for profits.

Electricity Supply

Lighting, Domestic, Power

Abertillery.—LOANS.—The Electricity Commissioners have sanctioned a loan of £7,000 for mains and services, meters and the wiring of consumers' premises, and the Urban District Council is to apply for sanction to borrow a further £7,000 for electrical development.

Aberystwyth.—ALL-IN TARIFF.—The Chiswick Electricity Supply Corporation, Ltd., has introduced an all-in domestic tariff with a "unit" charge of 1d. and a fixed charge of 5s. per living room and 2s. 6d. per bedroom per quarter.

Alton.—REDUCTION REQUESTED.—The Urban District Council has approached the Mid-Southern Electricity Co. with a view to securing a reduction in the charges for electricity.

Angus.—ELECTRICITY SUPPLY DELAYED.—Housing schemes at Hillside and Edzell in Angus have been wired for two years but are still without electric light, awaiting a decision as to whether the lines should be overhead or underground. The County Clerk is taking the matter up with the electricity company.

Ashton-under-Lyne.—REDUCED CHARGES.—The Electricity Committee has reduced the street-lighting charge in Limehurst from 2d. to 1½d. per kW.

Barnard Castle.—ELECTRICITY IN TEESDALE.—The North-Eastern Electric Supply Co. has submitted to the Rural District Council a scheme for the provision of electricity in the villages of Hilton, Ingleton, Headlam, and Gainford.

STREET LIGHTING.—Electricity is to be introduced for street lighting this year.

Bath.—PREPAYMENT METERS.—The Electricity Committee recommends, subject to the approval of the Housing Committee, the installation of prepayment meters in Council houses.

Beckenham.—LOANS.—The Urban District Council has applied for loans of £5,000 for meters, £2,000 for wiring consumers' premises, and £10,000 for domestic apparatus.

Bedford.—SUB-STATION DEVELOPMENTS.—It is proposed to lay two additional cables and to provide a 1,500-kVA transformer at an estimated cost of £4,469, and application for the necessary loan is to be made to the Electricity Commissioners. Land is to be acquired in the vicinity of Goldington for additional sub-station sites.

MAINS EXTENSIONS.—Mains are to be laid to Kempston, Marston, Wootton, Pavenham, Roxton, Ampthill, and Stewartby.

LOAN.—A sum of £6,331 has been expended by the Electricity Department in respect of overhead e.h.p. transmission lines and £1,720 in connection with the rural demonstration scheme. Application for sanction to borrow these sums is to be made to the Electricity Commissioners.

Blaenavon.—CHARGES.—As stated in our issue of December 29th, the supply was made available on December 19th. We now learn that the North Wales Power Co. is taking over the existing supplies in the Garn-yr-erw and Bunkers Hill districts. The two-part tariff includes a "unit" charge of 1d. for the first 125 kWh and ½d. thereafter, plus a fixed charge per room.

Blyth.—ELECTRICITY DEVELOPMENT.—The North-Eastern Electric Supply Co. has received sanction from the Town Council to wire for electricity more than 300 municipal houses on the Hodgson's Road and Plessey Road housing schemes. Tenders are to be invited for carrying out the work.

Boston.—EXTENSIONS.—The Electric Supply Co. has informed the Rural District Council that it has under consideration, extensions of the supply to Freiston, Butterwick, Benington, Leverton and Wrangle. It also proposes to construct a line from Mount Bridge, via Fishtoft and Freiston, to Arangle.

Cerrig-y-Druidion (Merioneth).—SUPPLY INAUGURATED.—The inauguration of the new electric lighting scheme took place on Sunday. The company, which supplies the town from its new hydro-electric station at Llanfihangel, was formed a little over three months ago.

Chester.—FRINGE ORDER.—The Electricity Committee has obtained a Fringe Order permitting the Corporation to supply electricity to the Bumpers Lane sewage disposal works.

Chesterfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £26,480 for mains and services for the next three years.

SHOWROOMS.—Showrooms for the Electricity Department are to be built in Holywell Street at a cost of £7,978.

Coatbridge.—AGREEMENT FOR SUPPLY REACHED.—The Town Council has authorised the signing of an agreement with the Clyde Valley Electrical Power Co., making provision for a supply of electricity in the burgh over a period of forty years. The decision brings to a close negotiations which have been carried on for several years and have been the subject of much controversy.

Cranbrook.—EXTENSION.—The Weald Electricity Supply Co., Ltd., is to extend its overhead mains in the Baker's Cross district.

Croft (Yorks).—OVERHEAD EXTENSIONS.—The Rural District Council has agreed not to oppose an application by the North-Eastern Electric Supply Co. to the Ministry of Transport for sanction to erect overhead l.p. lines at Cliffe, Manfield, Cleasby, and Stapleton. The company has stated that the supply of electricity to these areas depended upon the obtaining of the necessary wayleaves.

Crondall (Surrey).—ELECTRICITY WANTED.—The Parish Council has decided to ask the Mid-Southern Utility Company to supply the village with electricity by overhead lines.

Darlington.—EXTENSIONS.—No opposition is being offered by the Rural District Council to the erection of overhead l.p. lines by the North-Eastern Electric Supply Co., Ltd., at High Coniscliffe and Pierce Bridge.

MAINS EXTENSIONS.—The Town Council is to extend electric mains in Saltgate, Clifton Road, Bensham Road, Coniscliffe Road, Princess Street, and Shildon Street.

Eastbourne.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £5,000 for cookers and £4,754 for mains extensions.

Edinburgh.—ASSISTED-WIRING SCHEME.—The Public Utilities Committee has recommended approval of a hire-purchase scheme for the electric wiring of houses of £50 assessed rental or under. Under the scheme the basis of charge to the consumer will be the net cost of the installation as paid to the approved contractor, plus 10 per cent., the consumer to pay 25 per cent. of the total before the work is put in hand and the balance in twelve quarterly payments.

NEW MAINS.—The engineer and manager of the Electricity Department has recommended the laying of six additional trunk main cables between Portobello power station and a number of sub-stations in the city, owing to the growth of the undertaking. He proposes that the work should be done in the coming spring. The cost of the work, including switchgear, will amount to £60,000.

Elgin.—REDUCED CHARGES.—As from January 1st the lighting rate has been reduced from 7d. per kWh to 6d. per kWh up to 1,000 kWh, and 3d. beyond.

Errol.—SUPPLY INAUGURATED.—The supply of electricity in the village was switched on on December 29th.

Greenock.—CHANGE-OVER.—The change-over from d.c. to a.c. supply is to be extended. The estimated cost of carrying out extensions to the cable net work, equipping sub-stations, and altering consumers' apparatus and installations is estimated at £6,500.

MAINS EXTENSIONS.—In order to provide a supply of electricity in the Maukinhill area, cable extensions are to be made at an estimated cost of £4,175.

Hornsey.—FLOODLIGHTING AT BATHS.—Facilities for floodlighted bathing are being provided at the Hornsey open-air swimming pool at a cost of £1,000.

Isle of Man.—UNDERTAKING TRANSFERRED.—The Isle of Man Electricity Board has acquired the undertaking which supplies electricity to Laxey and the rural areas of Maughold and Lonan. The Board now has, therefore, a monopoly in every part of the Isle of Man outside of Douglas. The week prior to Christmas was a record week for the Board with regard to the number of applications for a supply of electricity which were dealt with, forty-five connections being completed. During the few months which have elapsed since the Board commenced operation 700 applications for supply have been received and 500 connections have been made.

Leeds.—REDUCED CHARGES.—The Electricity Committee has asked the City Council to reduce the minimum fixed charge to consumers on the residential supply scale from 36s. to 30s. per year, to take effect from the date of the December quarter meter readings.

Lewes.—REDUCED CHARGES.—The Lewes & District Electric Supply Co., Ltd., has introduced a domestic two-part tariff with a "unit" charge of 1d.

Lichfield.—BULK SUPPLY.—The City Council has informed the Rural District Council that an application is being made to the Electricity Commissioners by the Tamworth & District Electricity Supply Co., Ltd., for authority to supply electricity in bulk to Lichfield Corporation in order that a supply may be given to Elford.

SUPPLY EXTENSION.—The Rural District Council has consented to the City Council extending its overhead lines to give a supply to Whittington Hurst.

Sanction to a loan of £1,654 for an extension to Streethay has been received.

Llandudno.—REDUCED CHARGES.—With a view to embarking upon a scheme of electrical decoration for the Llandudno Pier, the Pier Company has applied to the Electricity Committee for a revision of the terms for the supply of electrical energy. The present tariff for the delivery of a.c. at 6,600 V to the company's sub-station is 10s. per kW of maximum demand per month, plus 1½d. per kWh. The Committee has now decided to abolish the kW demand charge and to supply energy at a flat rate of 2½d. per kWh.

London.—POPLAR.—The borough electrical engineer reports that the reblading and overhaul of Nos. 1 and 2 turbines has now been completed and that the results are satisfactory. The 15,000-kW machine has also been repaired and shows a

net gain in efficiency of 18¼ per cent. The "Underfeed" mechanical stokers operating Nos. 4, 5 and 6 boilers are giving satisfactory service, and the overall efficiency of these three boilers on a seventy-six hour test gave an average of 82.5 per cent. and a coal figure of 1.67 lb. per kWh generated. The pulverised-fuel boilers show an efficiency of 65 per cent. and a coal figure of 2.16 lb. per kWh generated. It is now possible to carry the load mainly on the stoker plant, and the saving in the fuel bill in one week amounted to £500 over the corresponding period of last year.

ASSISTED WIRING IN DEPTFORD.—As a result of an intensive canvassing campaign in connection with the London Electric Supply Corporation's assisted-wiring scheme, fifty-one applications were received in a month.

Maidstone.—MAINS EXTENSION.—The Town Council has decided to lay a loop main from Dean Street to Coxheath at an estimated cost of £1,265.

Manchester.—SPECIAL ORDER.—The Electricity Committee recommends the City Council to apply for a Special Order to supply the parishes of Carrington and Partington.

Marsworth.—SUPPLY WANTED.—The Parish Council has asked the Wing Rural District Council to bring pressure upon the Luton Town Council to carry out its obligations and provide a supply of electricity to the parish. This matter was previously taken up in 1931, but, although surrounding parishes have a supply, Marsworth is still waiting.

Morecambe.—EXHIBITION.—The Electricity Committee has decided to hold an electrical exhibition, with cookery demonstrations, at the School House, Overton.

Northleach.—OVERHEAD LINE.—The Rural District Council has received from the Wessex Electricity Co. plans for an overhead electric supply line along the Coln Valley, embracing five parishes. The scheme is to be discussed with representatives of the company.

North Wales.—OPPOSITION TO POWER BILL.—Both the Wrexham Rural District Council and the Caernarvonshire County Council have decided to oppose the Bill which the North Wales Power Co. is promoting. The Bill includes a clause as to the valuation of the hereditaments of the company. This, if it becomes law, will give the company the benefit of a deduction in arriving at the net annual value of its rateable properties, which is not allowed by the Rating and Valuation Act, 1925, and will reduce, to a very considerable extent, the rateable value of the parts of the company's undertaking.

Peterborough.—CENTRAL ELECTRICITY BOARD TAKES OVER.—Negotiations have taken place between Sir Andrew Duncan and other officials of the Central Electricity Board and the Peterborough Corporation concerning the terms upon which the Board is to assume control of the generating station of Peterborough this month. The Board will assume responsibility for the future operating costs of the generating station and for the outstanding liabilities, which are in the neighbourhood of £40,000, £300,000 capital having already been repaid. The Corporation will, in future, purchase the whole of the current consumed by its customers from the Board at a price which, on the basis of the revenue accounts for 1932-1933, permits the anticipation of a gross annual surplus of £30,000. After income tax and other charges have been deducted, a credit balance will be available for the reduction of the price of electricity to consumers. The Peterborough station will not be required to work to its full capacity. During June, July, and August the station will be entirely closed down so far as generation is concerned, and the staff will be employed in overhauling the plant.

Portland.—LOANS.—The Urban District Council has applied for loans of £1,000 for consumers' apparatus, £2,300 for general mains and services, and £700 for meters.

Preesall.—SPECIAL ORDER.—The Electricity Commissioners have made a Special Order authorising the Preston Town Council to supply electricity within the Urban District Council's area.

Preston.—LOAN.—The Electricity Committee is applying for sanction to borrow £3,000 excess expenditure on consumers' apparatus in connection with the change-over.

Rawtenstall.—PREPAYMENT METERS.—The Electricity Committee has decided to obtain prepayment meters and install them in desirable cases for ordinary consumers.

Reading.—UNDERTAKING TRANSFERRED.—The electricity undertaking became the property of the Corporation on January 1st.

Ruskington.—REDUCED CHARGES.—The Ruskington Electric Supply Co. announces a reduction in charges of from 1s. to 8d. per kWh as from January 1st. The company hopes to modernise the plant, and is prepared to supply electricity for power if there is a demand for it.

St. Neots (Hunts).—OVERHEAD LINE.—The Rural District Council has given permission to the Beds, Cambs & Hunts Electricity Co. to erect an overhead main from Abbotsley and Gamlingay, with a spur to Great Gransden.

Sheffield.—MAINS EXTENSIONS.—The Electric Supply Committee has approved of the expenditure of £4,944 on mains extensions.

Southend-on-Sea.—LOAN.—The Town Council has applied for a loan of £3,586 for the provision and equipment of transformer stations, £25,000 for mains, and £15,000 for services.

EXTENSION.—Subject to the consent of the County of London Electric Supply Co. and the Rochford Rural District Council, application is to be made for an Order to supply electricity to premises in Barling Road, Wakering, and on the Belfairs Garden Estate, Leigh.

Stirling.—DEMAND EXCEEDS SUPPLY.—The electricity works is at present unable to cope with the demands of the town and the situation was discussed at a recent meeting of the Town Council. It was reported that in a large factory in the town the power for a recently installed motor had to be cut off at three o'clock each day, and the electrical engineer said that the sub-stations were overloaded every night up to seven o'clock. The matter was remitted to the Electricity Committee for report.

Stokesley.—SUPPLY WANTED.—The Rural District Council has informed the North-Eastern Electric Supply Co., Ltd., that unless the supply of electricity at Ingleby Cross and other parishes is commenced immediately the Electricity Commissioners will be approached regarding the matter.

St. Gregory's Church, Norwich, the lighting of which is carried out by means of Holophane concentrating reflectors

Sutton-on-Sea.—SUPPLY SOON.—The Mid-Lincolnshire Electric Supply Company is to commence work during January for the supply of electricity to Sutton.

Tamworth.—UNDERTAKING NOT TO BE SOLD.—The Town Council has informed the Tamworth District Electricity Supply Co., Ltd., that the present offer for the transfer to the company of the Council's electricity undertaking cannot be accepted.

Todmorden.—LOAN.—The Electricity Committee is applying for sanction to a loan of £3,000 for domestic appliances.

Torquay.—NEGOTIATIONS WITH BRIXHAM.—A meeting has taken place between representatives of the Brixham Council and representatives of the Torquay Corporation. It was stated that the Brixham Council had passed a unanimous resolution asking the Corporation to become the undertakers for a supply of electricity in the urban district. It was decided that the necessary clauses should be inserted in the Corporation's Bill to enable this to be done, including the acquisition, if necessary, by compulsory powers of the electricity undertaking of the Brixham Gas and Electricity Company.

Torvean (Inverness).—CABLE OVER CALEDONIAN CANAL.—The Grampian Electricity Supply Company intends to erect h.v. overhead cable across the Caledonian Canal at Torvean. The cable will have a minimum headway of 125 ft. above the water level of the canal. The works will be carried out on January 14th and 15th.

Tredegar.—ELECTRICITY TO BE AVAILABLE.—The Urban District Council has now received sanction to proceed with the first part of the scheme for the supplying of electricity to the town. The Council applied in July last for permission to borrow £7,000, which will provide for an electricity supply for the business portion of the town. The whole scheme, when carried out, is estimated to cost about £30,000.

Wallasey.—SUPPLY TO WATERWORKS.—A scheme has been approved for the supply of electricity to certain pumping machinery at the Gorsehill waterworks at a cost of £240.

NEW MAINS.—The Corporation has asked the Electricity Committee to spend up to £5,000 on the renewal of old mains for the purpose of providing work for the unemployed.

Warrington.—LOAN.—The Electricity Committee is applying for sanction to a loan of £20,000 for mains and services.

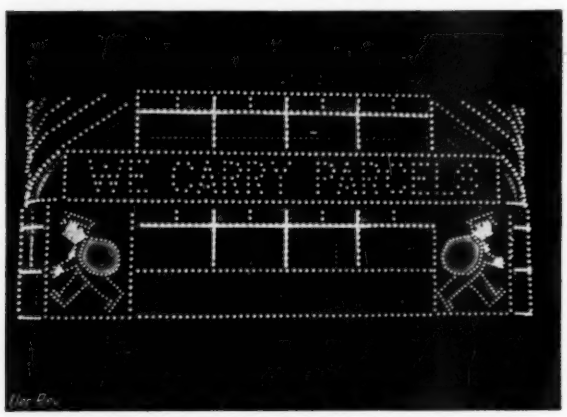
Wigton (Cumberland).—SUPPLY EXTENSIONS.—The Mid-Cumberland Electricity Co. has written to the Rural District Council stating that the village of Waverton is not in favour of a supply, but schemes are being formulated for other parts of Wigton and the company hopes to make a start soon. These schemes are for an extension from Aspatria to Hayton and Allonby, and Aspatria to Baggrow and Blennerhasset. In addition a canvass is to be taken of the surrounding villages to ascertain the demand, while a canvass is also to be taken of Kirkhampton and Kirkbride.

Worthing.—MAINS EXTENSION.—The Electricity Committee is to extend mains in the Poulters Lane area at a cost of £1,210.

Traction

Austria.—RAILWAY ELECTRIFICATION.—The Austrian Government is reported to have received from Sir Osborn Mance a report which he was commissioned to prepare on the suggested electrification of the section between Salzburg and Linz. The conclusion reached is that the conversion of this section to electric traction cannot be recommended unless at the same time the electrification of the line between Linz and Vienna is ensured. It is estimated that the entire work between Salzburg and Vienna would involve an expenditure of 150 million schillings as a large outlay would be needed for strengthening the permanent way.

Belgium.—RAILWAY ELECTRIFICATION.—Some interesting details of the electrification of the railway between Brussels and Antwerp, which is about to be commenced, are given in the November *Bulletin* of the Société Belge des Electriciens. They are based on a report drawn up by M. Waucquez, a Belgian senator, and presented by him to the Government on behalf of the Commission des Transports. The distance between the two cities is approximately thirty miles. The initial scheme provides for the electrification on the 3,000-V d.c. system of the existing track for express trains—one line in each direction—the other lines being reserved for international steam trains and goods traffic. The work is estimated to cost 116 million fr., or, reckoning 125 fr. to the £, £928,000, including £292,000 for locomotives and £120,000 for passenger carriages. With the exception of a limited quantity of special apparatus, the whole of the material to be used will be of Belgian manufacture. At present the fastest steam train between the two cities occupies thirty-six minutes, the usual time being, however, about forty-five minutes. The



An illuminated tramcar, carrying over 2,500 lamps, which was a feature of the recent Edinburgh Civic Week illuminations

electric non-stop trains are being designed to do the journey in thirty minutes, or in thirty-three minutes with a stop at Malines. At the present time thirty-six trains per day are being run; when the electric line is completed it is proposed to increase the number to fifty-seven, and, later, to seventy-four.

Blackpool.—LOUDSPEAKERS ON TRAMS.—The Corporation is to fit trams with loudspeakers through which drivers may announce the stops.

Edinburgh.—TRAMWAYS EXTENSION.—The Corporation is to carry out important extensions of the tramway undertaking at a cost of over £83,000. The work includes the extension of the tramways at Braid Hills Road to Fairmilehead (£22,220), to Hill Park (£16,000), in Ferry Road from Granton Road to Crewe Toll (£19,365), and an extension at Corstorphine (£8,000).

France.—DIESEL-ELECTRIC TRAINS.—At a recent meeting of the Société des Ingenieurs Civils in Paris, M. Metenier, of the Société Franco-Belge de Material de Chemins de Fer, announced that his company had received an order from the Northern Railway Co., of France, for two Diesel-electric trains for an express service between Paris and Lille. Each train will comprise two motor-equipped passenger-carrying vehicles with a non-motor carriage between them. Each of the motor vehicles will be equipped with two four-wheel bogies, above one of which will be mounted a Diesel V-type ten-cylinder oil engine developing 400 h.p. at 1,400 r.p.m. and direct coupled to a dynamo. Each of the axles of the second bogie will be driven by a 200-h.p. electric motor. The vehicles will be fitted with hydraulic servo-operated brakes on all wheels and an emergency electro-magnetic brake.

Germany.—TROLLEY-BUSES IN BERLIN.—The trolley-bus service between Spandau and Staaken was inaugurated on December 24th.

Glasgow.—TROLLEY-BUSES.—The Provisional Order being promoted by the Corporation seeks power to use trolley vehicles along the route of any of the tramways.

Leicester.—ABOLITION OF TRAMS.—The Lord Mayor has advocated the complete abandonment of tramways in favour of motor buses, as the latter have already replaced the trams on certain routes in the city.

Middlesbrough.—BUSES REPLACE TRAMS.—The Northern Area Traffic Commissioners have sanctioned the Town Council's proposal to change over its transport system from trams to buses.

Plymouth.—TROLLEY-BUSES.—The Transport Committee has asked the manager to report on the practicability and cost of converting two tramway routes to trolley-bus working.

Tynemouth.—TRACK RENEWAL.—The Corporation is to commence the reconstruction of the tramway route at a cost of £24,000.

Traffic Signals.—The Kingston-on-Thames Town Council has decided to install automatic traffic signals at the Eden Street junction and at the London Road-Richmond Road junction, at a cost of £555. Automatic traffic signals are to be installed by the Beckenham and Penge Urban District Councils at the junction of Green Lane and Parish Lane. The Chester Corporation has decided to install traffic signals at each end of the Old Dee bridge to be operated manually from the centre of the bridge. The Chorley Corporation is to obtain tenders for the provision of automatic traffic signals in Market Street.

Six more double traffic signals are to be installed at Hyde Park Corner, London, and the Hackney Borough Council is to install signals at thirteen points in Hackney at a cost of £7,427.

Communications

Belgium.—RUYSSELEDE.—The long-wave (18,000 m.) section of the Ruysselede radio station has been put out of action through the collision of the Imperial Airways liner *Apollo* with the aerial mast. The long wavelength serves New York, Buenos Aires and Beirut, and until the mast can be reconstructed all transmissions will have to take place on 22.78 metres.

Egypt.—WIRELESS FOR VILLAGES.—The Egyptian Government is to broadcast official lectures on social, agricultural, and sanitary problems for the benefit of Egyptian villagers, in connection with which scheme a four-year plan is being considered for the installation of wireless sets in 2,000 villages in Upper and Lower Egypt.—*Reuter* (Cairo).

Great Britain.—GROUP TELEPHONE SERVICE.—In all but the smallest of exchange areas, group service is to be offered at rates which will be lower than the normal, except when considerable use is made of the service. Not more than eight, and not less than four, subscribers within 350 yards of each other will share a common exchange line. Two subscribers in the same group will not be able to speak to each other, or use their instruments at the same time. But they will have separate numbers and be able to initiate and receive calls independently without being overheard. They will be offered the choice of a measured or message rate. The new service is to be introduced in April.

B.B.C.'s YEAR'S WORK.—In a review of outstanding events in British broadcasting during 1933, the B.B.C. states that the transmission time (excluding the Empire station) amounted to 59,966 hours 12 minutes, the average breakdown being 0.019 per cent. The Empire station transmitted for 9,459 hours 50 minutes.

The most important new work has been the construction of the new National programme long-wave transmitter at Droitwich, to replace Daventry (5XX), and the installation of plant will begin shortly. On the site for the Northern Ireland Regional station preliminary building work is now in hand. In July the West Regional station completed the chain of four twin-transmitter Regional stations. Progress has been made with the modernisation and extension of studio premises and equipment. Research has continued on new types of microphone, the correct acoustical design of studios, methods of ensuring frequency constancy of transmitters, the transmission of high-definition television on ultra-short wavelengths, and many other matters.

The modified wavebands for broadcasting, agreed at the Madrid conference of 1932, will come into operation on January 15th. The Central Council for School Broadcasting has now completed five years of service. Six hundred and thirty new listening schools have been added to the register since January 1st, 1933. Great interest has been shown by local education authorities in the lists of approved apparatus suitable for use in schools, and demonstrations of school broadcasting have been given all over the country. The programme correspondence comprises 80,000 to 100,000 letters a year, and satisfaction is expressed or implied by correspondents in twenty letters to every one expressing dissatisfaction.

London.—BATTERSEA.—The Electricity Committee recommends that in connection with the change-over of the Council's distribution system from d.c. to a.c. the cost of making all consumers' apparatus used on the Council's mains, including wireless apparatus, suitable for the new system shall be borne by the Council, provided it has been installed prior to the service on the consumer of the notice of intended change-over.

Northern Ireland.—TELEGRAPH REORGANISATION.—During a visit to Belfast in January, the Postmaster-General will declare open the completely reorganised telegraph and phonogram department of the Belfast Head Post Office. Following Birmingham, Manchester, and Leeds, Belfast is the fourth telegraph zone in the United Kingdom to be reorganised.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Argentina.—BUENOS AIRES.—January 25th. State Oilfields. Motors and transformers, with switch and control gear. (A.Y. 12141.)*

Army Contracts.—Manufacturers who are not on the War Office list of tenderers and wish to be invited to tender for general stores should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, S.W.1. (See this issue.)

Australia.—MELBOURNE.—Post and Telegraph Department. January 16th. Telephone timing clocks. (A.Y. 12085.)* Telephone switchboard keys and accessories. (A.Y. 12081.)* Resistances and reactances. (A.Y. 12083.)*

January 23rd. Telephone trunk test boards. (A.Y. 12091.)*

February 6th. Telephone induction coils and registers. (A.Y. 12127.)*

State Electricity Commission of Victoria. January 8th. Five automatic induction voltage regulators. (A.Y. 12071.)* 115-kW a.c. motor. (A.Y. 12053.)*

January 15th. Triple-braided copper conductor. (A.Y. 12054.)*

January 30th. Telephone handsets. (A.Y. 12113.)*

BRISBANE.—January 31st. City Electric Light Co., Ltd. Land and submarine cable. (A.Y. 12072.)*

February 7th. 44-kV switchgear. (A.Y. 12092.)*

Belfast.—January 19th. Electricity Department. Stores for twelve months commencing April 1st. (December 29th.)

Belgium.—BRUSSELS.—February 23rd. Municipality. Supply and installation of a 20,000-kW steam turbo-generator. Particulars and plans (125 fr.) from 11, Rue Ste. Catherine.

Beverley.—January 8th. Lighting installation at Walkington Mental Hospital. County architect, County Hall, Beverley (deposit £3 3s.). Tenders to Mr. G. Macdonald, clerk to the Visiting Committee, East Riding Mental Hospital, County Hall.

Birmingham.—January 8th. Corporation Mental Hospitals Committee. Installation of a complete system of underground electric mains and services, &c., at Winson Green Mental Hospital. Copies of the special conditions, specification, &c. (deposit £2) may be obtained from city engineer and surveyor, Council House.

Blackpool.—January 22nd. Corporation. Stores, materials, &c., for 1934-35. (See this issue.)

Burton-upon-Trent.—January 31st. Corporation. Underground and overhead cables. (See this issue.)

Cupar (FIFE).—January 6th. District Asylum Works Department. Materials for twelve months, including electric lamps and fittings. Forms from Resident Clerk of Works; tenders to Dr. W. Boyd, Medical Superintendent, Fife District Asylum.

Dundee.—January 10th. Electricity Department. Electric battery shunting locomotive. (December 29th.)

Edinburgh.—January 25th. City Council. E.h.p. switchgear for Portobello power station. (See this issue.)

Egypt.—ALEXANDRIA.—February 26th. Ministry of Communications. Cable, switchgear, transformers, hauling winches and motors. (A.Y. 12094.)*

CAIRO.—January 16th. Ministry of Education. Electric muffle furnace, electro-plating motor-generator, &c., for school at Giza. (A.Y. 12115.)*

January 27th. Ministry of Public Works. Two complete full automatic refrigerating units, insulating material and special air-tight insulated doors. (A.Y. 12146.)*

February 3rd. Electrically driven reciprocating pump. (G.Y. 13311.)*

Erith.—January 15th. Electricity Department. Laying, jointing and testing of 11½ miles of h.p. and l.p. cables. (December 29th.)

Hull.—January 16th. Electricity Department. Stores for twelve months from April 1st. (See this issue.)

Liverpool.—January 24th. Corporation. Materials for twelve months ending March 31st, 1935, including cables, meters, lamps, a.c. motors and starting gear, cookers, kettles, &c. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—January 10th. 33-kV overhead transmission lines for the South-East England Electricity Scheme. (December 22nd.)

ISLINGTON.—January 17th. Borough Council. Electrical and engineers' stores for one year commencing April 1st, 1934. (December 8th.)

HACKNEY.—January 24th. Electricity Department. Meters and demand indicators. Kiosks, e.h.p. and l.p. switchgear and transformers. (December 29th.)

Cables and cords for twelve months, commencing April 1st. (See this issue.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department. January 16th. Thirty-five miles of v.i.r. wire. (A.Y. 12086.)*

January 17th. Forty miles of flameproof telephone jumper wire. (A.Y. 12088.)*

January 30th. 300 Planté positive batttery plates. (A.Y. 12104.)* Two hot-cathode type rectifiers. (A.Y. 12106.)* Twenty 130-ohm resistance spools. (A.Y. 12105.)*

January 31st. One stationary battery of twelve unburnt cells. (A.Y. 12107.)*

February 5th. Seventy-five tons of hard-drawn copper wire. (G.Y. 13208.)*

February 6th. 71,000 dry cells for telephone use. (A.Y. 12101.)*

February 13th. Twenty-four 0·8430 ohm rheostats. (A.Y. 12103.)* Fifty miles of tinned copper v.i.r. wire. (A.Y. 12108.)*

February 19th. 1,000 ebonite or bakelite telephone earpieces. (A.Y. 12133.)*

January 16th. Public Works Department. Four 1,500-kVA transformers. (A.Y. 12017.)*

January 31st. Government Stores Control Board. Electric lamps for one year. (A.Y. 12128.)*

February 19th. Inset transmitters, bakelite mouthpieces and microtelephone plungers for automatic table telephones. (A.Y. 12131.)*

Northern Ireland.—BELFAST.—January 18th. County Borough Council. Maintenance of electrical window cleaning installation at the Museum and Art Gallery for twelve months from April 1st. Town Clerk.

Electricity Committee. January 19th. Stores and materials for twelve months from April 1st, including meters, instrument transformers, maximum-demand indicators, time switches, cut-outs, static transformers, transformer kiosks with h.p. and l.p. switchgear, and electric kettles (deposit £2 2s.). Electrical installations in residences under the Corporation assisted wiring scheme during the twelve months ending January 31st, 1935 (deposit £2 2s.). Town Clerk.

Tramway Committee. January 23rd. Supply of stores for twelve months from April 1st, including electrical accessories, cable, insulation armature coils, field coils and lamps. Town Clerk.

Runwell (ESSEX).—February 28th. East Ham and Southend-on-Sea Joint Visiting Committee. Electrical installation at Mental Hospital. (December 22nd.)

Saltcoats (AYRSHIRE).—January 10th. Town Council. Various works, including electric lighting, at forty-two houses. Schedules, &c., from H. Thomson & Sons, architects, 60, Hamilton Street (£1 1s.). Tenders to the Joint Town Clerks.

South Africa.—PRETORIA.—March 2nd. City Council. Turbo-alternator, condensing plant and anxiliaries, boilers and electrically operated crane. (December 22nd.)

BULAWAYO.—February 1st. Municipality. One 4,000-kW turbo-alternator, switchgear, and transformers. (A.Y. 12122.)*

GWELO.—February 6th. Municipality. Equipment for extensions to electricity undertaking comprising two 1,000-kW turbo-alternators, pumps, crane, switchgear, transformers, &c. (A.Y. 12124.)*

JOHANNESBURG.—January 15th. Railways and Harbours. Train lamps and fittings. (G.Y. 13168.)*

January 20th. City Council. One summation equipment, complete with transmitting meters, printometers, time switches and panel. (A.Y. 12136.)*

CAPE TOWN.—January 31st. Electricity Department. 4,000 15-A four-pin plugs and sockets. (A.Y. 12137.)*

4,000 metal-clad house-service switch and fuse boards. (A.Y. 12138.)*

DURBAN.—February 2nd. Corporation. Lead-covered dry-core p.i. cables. (A.Y. 12135.)* Private branch exchange telephone switchboards and spare equipment. (A.Y. 12132.)*

Swansea.—February 8th. Electricity Department. Sulphur and dust extraction plant, lime plant and ash plant for Tir John power station. (See this issue.)

Tottenham.—January 16th. U.D.C. Renewal of electrical installation in the Town Hall and Central Baths. (December 15th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bath.—Watch Committee. Recommended. Installation of "Electromatic" vehicle-actuated light signals at New Bond Street and Northgate Street (£473); Union Street and Westgate Street (£471); Southgate Street and Lower Borough Walls (£526).—Automatic Electric Co., Ltd.

Blackpool.—Electricity Committee. Accepted. Switchgear.—Switchgear & Cowans, Ltd.

Cowdenbeath (FIFE).—Town Council. Accepted. Electrical work at scheme of eighty houses (£348).—J. Scott & Co.

Dumfries.—Dumfries and Galloway Joint Sanatorium Board. Accepted. Installing central electric cooking apparatus and equipment at the Sanatorium (£580).—Jackson Electric Stove Co., Ltd. Additions and alterations to the wiring installation (£351).—P. Drummond & Son, Ltd. Overhauling and modernising the X-ray apparatus (£661).—Schall & Son.

Durham.—County Education Committee. Accepted. Installation of electric lighting in schools.—Boldon Colliery North Road Council School (£149).—Law & Burns; Birtley George Street Council School (£126).—B. L. Oliver; Leeholme Council School (£225).—Falconar, Cross & Co., Ltd.

Eastbourne.—Electricity Committee. Accepted. Switch units (£146 each) and 30-V "Nife" tripping batteries (£18 10s. each).—Ferguson, Pailin, Ltd.

Enfield.—Middlesex Assistance Committee. Accepted. Internal telephone installation at poor law premises (£170).—Siemens-Schuckert (Great Britain), Ltd.

Glasgow.—Housing Committee. Accepted. Electrical installation at houses at Shawpark and Whitelaw Street (£279).—Darroch & Espie.

Transport Committee. Accepted. Charging set for "Nife" battery.—F. W. Murray. Automatic signalling equipment for subway.—Westinghouse Brake & Saxby Signal Co., Ltd.

Harold Court.—Essex County Council. Accepted. X-ray transformer unit for sanatorium (£367).—Watson & Sons, Ltd.

Manchester.—Health Committee. Accepted. Electric bed lift at Withington hospital.—W. Wadsworth & Sons, Ltd.

Education Committee. Accepted. Electrical installation at Royal Oak school.—Seddons & Sons.

Electricity Committee. Accepted. Water heaters for twelve months.—A. Low & Sons, Ltd.; Electric Fires, Ltd.; Ferranti, Ltd.; Aidas Electric Co., Ltd.

Middlesex.—Highways Committee. Accepted. Traffic signals at Staines Road (£351) and Barnet (By-pass) (£401).—Automatic Electric Co., Ltd.

Portsmouth.—Libraries Committee. Accepted. Installation of electric lighting at Carnegie branch library (£107).—Shields and Marshall.

Northern Ireland.—BELFAST.—Education Committee. Accepted. Electric lighting installation at Lancaster Street School.—J. J. & R. McCloskey.

Sheffield.—Corporation Electric Supply Committee. Accepted. Transformers (£329).—Electric Construction Co., Ltd. Two 20,000-kVA transformers (£13,917).—English Electric Co., Ltd. E.h.p. switchgear (£8,083).—British Thomson-Houston Co., Ltd.

Shipley.—Libraries Committee. Accepted. Rewiring Carnegie library (£145).—G. Binns.

Smethwick.—Gas Committee. Accepted. Electrical generating plant (£302).—Belliss & Morcom, Ltd.

Wood Green.—Works Committee. Recommended. Electric lighting installation at destructor works (£96).—North Metropolitan Electric Power Supply Co.

Todmorden.—Electricity Committee. Accepted. Switchgear and steel kiosk (£251).—Yorkshire Switchgear Co., Ltd. Transformer (£88).—Yorkshire Transformer Co., Ltd. Transformer (£100).—Craven & District Electrical Construction Co., Ltd.

Willesden.—Middlesex Assistance Committee. Accepted. Electric lighting at children's home (£110).—T. Clarke & Co.

Tynemouth.—Town Council. Accepted. Additional regulating transformer (£330).—Ferranti, Ltd. Installation of electric lighting in ninety-six houses to be built on the Ridges Estate (£444).—J. Mayo & Co.

Wallasey.—Electricity Committee. Accepted. Two rectifiers (£957).—English Electric Co., Ltd. One 250-kVA transformer (£136).—Yorkshire Electric Transformer Co., Ltd.

Forthcoming Events

Association of Mining Electrical Engineers.—(*Kent Sub-Branch*).—Saturday, January 6th. Dover Technical Institute. 6.30 p.m. "Mining Cables," by Mr. W. W. Watkins. (*London Branch*).—Tuesday, January 9th. Junior Institution of Engineers, London. 6.30 p.m. "The Electrical Equipment of a Large Cement Works," by Mr. E. E. Pickett. (*South Wales Branch*).—Saturday, January 13th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Fabricated Construction as Applied to Electrical Mining Gear," Mr. J. A. Dorrat. (*West Wales Branch*).—Saturday, January 13th. Y.M.C.A., Swansea. Discussion on "Underground Illumination," opened by Mr. S. T. Richards.

Institution of Engineers-in-Charge.—Saturday, January 6th. Institution, London. 7 p.m. Dance. Wednesday, January 10th. 7.30 p.m. Paper by Mr. E. G. Phillips, "The Case for the Private Plant."

Institution of Electrical Engineers.—Monday, January 8th. Institution, London. 7 p.m. Informal meeting. Discussion on "Speed Regulation of Small a.c. Motors (under 5 h.p.)." Opened by Mr. D. B. Hoseason. (*Meter and Instrument Section*).—Friday, January 5th. Institution, London. 7 p.m. "The Equipment and Operation of a Modern Meter and Test Department." Mr. J. B. Lees (*Mersey and North Wales (Liverpool) Centre*).—Monday, January 8th. University, Liverpool. 7 p.m. (Subject not announced.) (*North-Eastern Centre*).—Monday, January 8th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Electromagnetic Phenomena in High-Voltage Testing Equipment." Mr. B. L. Goodlet. (*North Midland Centre*).—Tuesday, January 9th. Hotel Metropole, Leeds. 7 p.m. "The Bypath Automatic Telephone System." Messrs. J. H. E. Baker and E. P. G. Wright. (*North-Western Centre*).—Tuesday, January 9th. Engineers' Club, Manchester. 7 p.m. "Some Aspects of the Electrical Transmission of Power by Means of Super-Tension Direct Current." Mr. H. Rissik. (*Scottish Centre*).—Tuesday, January 9th. North British Station Hotel, Edinburgh. 7 p.m. Informal Meeting. "The New Telegraphy." Mr. R. MacWhirter. (*Hampshire Sub-Centre*).—Wednesday, January 10th. University College, Southampton. 7.30 p.m. "Some Problems of Rural Electrification." Mr. R. M. Charley. (*London Students' Section*).—Wednesday, January 10th. Visit to Messrs. W. T. Henley's Telegraph Works Co., Ltd., Gravesend. Friday, January 12th. Institution, London. 6.15 p.m. Informal discussion on "Are Recent Advances in Electro-Acoustics Appreciated?" (*Dundee Sub-Centre*).—Thursday, January 11th. University College, Dundee. 7.30 p.m. "Costing." Mr. R. J. Lawson.

Illuminating Engineering Society.—Tuesday, January 9th. Institution of Mechanical Engineers, London. 7 p.m. "Portable Lamps and their Applications." Mr. A. Cunnington.

Edinburgh Electrical Society.—Wednesday, January 10th. 4, Queen Street, Edinburgh. 8 p.m. "Talking Picture Engineering." Mr. C. A. Wild.

British Electrical Development Association.—(*Northern Counties Area*).—Friday, January 12th. Oxford Galleries, Newcastle-on-Tyne. Annual Carnival.

Society of Chemical Industry.—Friday, January 12th. Burlington House, London. 8 p.m. Joint meeting of Engineering and Plastics Groups. "Plastics as Engineering Material." Mr. H. L. Rowell.

Electrical Contractors' Association.—(*Bristol Branch*).—Friday, January 12th. Grand Hotel, Bristol. 6.30 p.m. for 7 p.m. Annual dinner and dance.

Makers' Names Wanted

Chain pull holder, No. 37553.

BEST mining relighter.

HUGHES balance.

MICRODYNE fractional h.p. motor.

Notes

Dispelling Fogs Electrically

An "Electrodrome" has been erected at Whittier, California, by the inventor, Mr. William Haight. Its purpose is to dispel ground fog and frost by electricity. According to the *Electrical World*, it is claimed that with negative discharge atmospheric moisture may be driven into high cloud areas, thus preventing local formation of frost. Ground fogs are alleged to be capable of local dissipation in a similar manner. In his experiences with the electrodrome, Mr. Haight reports finding from thirty minutes to two hours to be necessary for creating the high, frost-preventing cloud area over a radius of three miles from the tower. The record for precipitating fog is two minutes, although it has ordinarily taken from eight to twenty minutes over the three-mile radius affected by the present electrodrome.

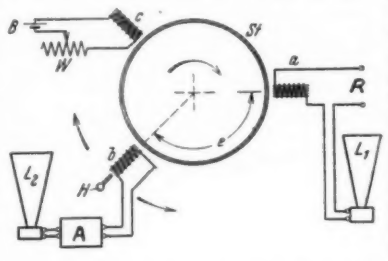
The invention is based on the theory that electric currents flowing between the magnetic poles sway and dip, causing a greater or less flow of energy to the earth at certain points. Such a flow of electrical energy causes clouds, fogs and such forms of condensation of atmospheric moisture. The function of the electrodromes is to create artificially such a condition by means of negative electrical discharges, thus exciting a greater flow of positive energy towards the earth when and where needed.

Conference on Atomic Physics

A conference on atomic physics is to be held this year under the auspices of the Physical Society. It will be opened by Lord Rutherford and will be the first of its kind to be held in England. The conference will last two days at least, and the meetings will be held in London and Cambridge.

Improved Radio Reproduction of Music

The accompanying illustration, says H. Dillge in *Elektrotechnische Zeitschrift*, shows the essential features of a device for obtaining an adjustable "space tone" effect or plasticity of reproduction in radio reception. The new method, which is applicable to ordinary reception from single-microphone transmission from a studio without an echo chamber, is analogous to the Küchenmeister method of obtaining an echo effect from gramophone records by the use of two sound boxes one after the other.



An endless steel wire is mounted on the rim of a rotating disc, of about the size of a gramophone record. An electromagnet, *a*, in parallel with the primary loud-speaker L_1, and connected to a receiving set at R, records the reception magnetically in the steel wire, which then passes on to the pick-up magnet *b* and reproduces the signals in the second loud-speaker L_2, through the amplifier A. The second reproduction lags behind the first by an interval determined by the adjustable angle *e* and the speed of rotation of the disc. Finally, the magnet *c*, excited by direct current, erases the record from the wire, so that a single turn can be used repeatedly. The two loud-speakers must be mounted at a distance apart suited to the timing of the echo effect.

Mining Electrical Engineers' Dinner

The South Wales Branch of the Association of Mining Electrical Engineers is holding its annual dinner on January 20th at the New Continental Café, Cardiff.

Electricity Area Maps

A map of the North-West England and North Wales electricity supply area has been published by Edward Stanford, Ltd., 12, Long Acre, W.C.2. It is printed in distinctive colours, and by means of an index shows the areas of all authorised undertakers in the district as at December, 1933. The map is drawn to a scale of four miles to an inch and is printed on linen-backed paper, the size of the sheet being 35 in. by 44 in. It is the third of a series; the two relating to South-East and Central England were published in 1930 and 1932. The price is 10s. 9d. post free.

The "Avominor"

We are informed that the "Avominor" mentioned in an article on "Radio Testing Apparatus" last week has a resistance range to 3 megohms, not 1.2 as stated, and the voltmeter 332 ohms per volt, not 167.

The Electrical Association for Women

Mr. H. Moss will give a lecture and demonstration to the members of the Bradford branch of the Electrical Association for Women on "Safety First with your Electrical Installation" on January 17th. He will give the same lecture to the Leeds branch on April 4th.

Appointments Vacant

Lady demonstrator, meter tester, and temporary apparatus inspector for Stoke Newington Electricity Department.
(See our classified advertisements.)

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

New Year Honours.—We offer our congratulations to the following gentlemen, who figure in the New Year Honours List which was published on Monday last:—

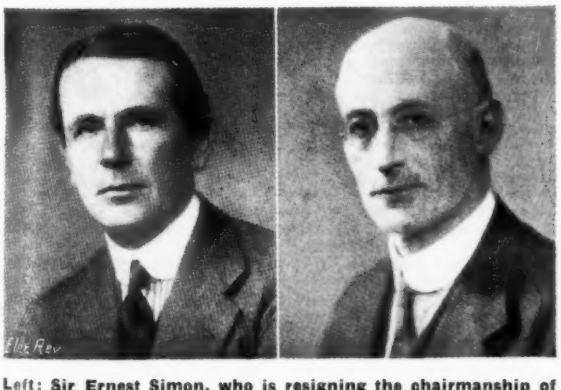
Sir George Douglas C. Newton, K.B.E., M.P., who receives a barony, is a director of Edmundson's Electricity Corporation, Ltd.; the Shropshire, Worcestershire & Staffordshire Electric Power Co.; and the Beds, Cambs & Huntingdonshire Electricity Co. He was elected a Companion of the Institution of Electrical Engineers in 1932. **Sir William R. Morris,** O.B.E., D.C.L., chairman of Morris Motors, Ltd., also becomes a baron. **Mr. P. J. Pybus,** C.B.E., M.P., M.I.E.E., Minister of Transport from 1931 to 1933, and formerly chairman of the English Electric Co., Ltd., and a director of various other companies, has been made a baronet. **Lord Weir,** managing director of Messrs. G. & J. Weir, Ltd., of Glasgow, and chairman of the Weir Committees on Electricity Supply and Railway Electrification, has been awarded a G.C.B. (Civil Division), and **Mr. H. P. Brown,** M.B.E., M.I.E.E., Director-General, Postmaster-General's Department, Australia, becomes a C.M.G.

Included in the India Office List are **Mr. L. H. Greg,** chief engineer to the Madras Public Works Department; **Mr. J. R. T. Booth,** Senior Deputy Director-General of the Indian Posts and Telegraphs, who receive the C.I.E.; and **Messrs. H. P. Bhaumik,** Superior Telegraph Engineering Service, Electrical Engineer-in-Chief, Posts and Telegraphs Department, **A. Gemmell,** assistant to Messrs. Heatly & Gresham, of Calcutta, and **C. C. Paul,** deputy chief engineer to the Public Works Department of the Nizam's Government, Hyderabad (Deccan), who are awarded the O.B.E. **Mr. P. R. Hadow,** chief engineer of the Irrigation Branch of the Punjab, is made a knight.

Mr. M. C. Pink, Deputy Controller of the London Telephone Service of the G.P.O., receives the O.B.E., and **Mr. C. W. Burge,** staff officer in the Engineer-in-Chief's office of the G.P.O., the M.B.E. The Diplomatic List includes **Mr. W. J. Glenny,** Commercial Counsellor in H.M. Legation at Stockholm, who is awarded the C.B.E.

In the New Year Honours List

Sir Douglas Newton (*Press Portrait Bureau*); Lord Weir (*Elliott & Fry*); Sir William R. Morris, Bt. (*Elliott & Fry*); Mr. P. J. Pybus (*Vandyk*); and Mr. M. C. Pink (*French & Co.*)



Left: Sir Ernest Simon, who is resigning the chairmanship of Henry Simon, Ltd., and (right) his successor, Mr. C. Bentham

Mr. F. M. Fletcher, electrical engineer to the Darwen Corporation, was married recently to Mrs. Dorothy C. Brown.

Mr. J. Newton has been appointed tramway manager to the Warrington Corporation at a salary of £450 per annum, rising to £550.

Mr. C. C. Higgens, A.M.I.E.E., has resigned his appointment with Messrs. Bruce, Peebles & Co., Ltd., whom he has represented in Yorkshire for some years, in order to join the sales staff of the Eyre Smelting Co., Ltd. From February 1st his address will be c/o that company, Tandem Works, Merton Abbey, S.W.19.

Nine candidates have been selected to appear before a sub-committee of the Ealing Corporation Electricity Committee on Monday next for the appointment of a borough electrical engineer and manager in succession to **Mr. J. D. Knight,** who is to retire on superannuation. The sub-committee will reduce the number to seven, and the full Electricity Committee will later in the day select four, to be presented to the Council at a meeting to be held on Tuesday.

Mr. Leonard Clarke, A.M.I.Mech.E., late chief draughtsman of the British Electric Transformer Co., Ltd., is now managing director of L. Clarke & Co., Ltd., Southall, Middlesex, welding specialists.

The friends of **Mr. W. E. Bush,** general manager of the Curtis Lighting-Europe S.A., are asked to note that his address is now 139, Boulevard de la Seine, Neuilly S/Seine (Seine).

The title of the consulting engineering practice of Digby & Fairthorne, 6, Queen Anne's Gate, S.W.1, has been recently changed to **W. P. Digby & Partners,** but there will be no immediate change in management.

Miss F. G. Lynton, cookery demonstrator and showroom assistant with the Douglas Corporation Electricity Department, has been appointed to a similar position with the Birkenhead Corporation.

Mr. B. N. Binder has resigned the chairmanship of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., in favour of **Sir Walrond Sinclair.** At the annual meeting of the company held on Friday last, Mr. Binder explained that he intended to remain as a director to collaborate with the new chairman, but now that the company was controlled by the British Goodrich Rubber Co., Ltd., he felt that control should be direct. Sir Walrond is chairman of the British Goodrich Rubber Co.

Dr. J. L. Miller, who read a paper before the I.E.E. in London yesterday, on "The Influence of Certain Transmission-Line Associated Apparatus on Travelling Waves." **(See page 14)**

Mr. R. W. Gregory has relinquished his partnership in the firm of Messrs. Merz & McLellan, but is retained in an advisory capacity.

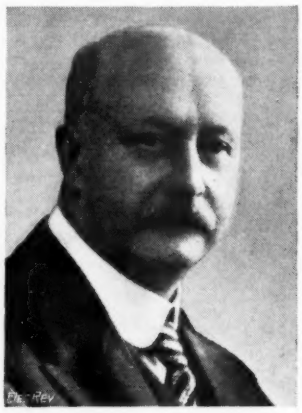
Mr. C. J. Spencer has been recommended by Lord Ashfield to the Johannesburg City Council to act on the commission which is to inquire into the municipal transport system. Mr. Spencer was general manager of the tramways of the Underground Group until they were taken over by the London Passenger Transport Board, when he continued as general manager of the northern and western areas. He resigned recently on being appointed resident director of the North Metropolitan Electric Power Supply Co.

Sir Ernest Simon has resigned the chairmanship of Messrs. Henry Simon, Ltd., Stockport, to devote himself to public work; he will remain on the board of the company. His successor in the chair is **Mr. Cecil Bentham,** M.Inst.C.E., who has been on the board of the company since 1916 and was appointed managing director in 1926.

Mr. G. L. Kirkpatrick, general manager of Messrs. Bruce Peebles & Co., Ltd., has been appointed general managing director of the company as from January 1st.

Obituary

Mr. C. F. Mackness.—We regret to record the death of Mr. Cyril Francis Mackness, M.I.E.E., M.Am.I.E.E., which occurred on December 17th, after a brief illness, at the age of fifty-eight. Mr. Mackness, who was the son of the late Canon George Mackness, D.D., of Broughty Ferry, was educated at the High School, Dundee, and he left there to join the staff of the local branch of the Bank of Scotland, but having a bent for engineering he apprenticed himself to the Sunderland Forge & Engineering Co., Ltd., in 1898. Two years later he joined Messrs. Bruce Peebles & Co., Ltd., in Edinburgh, and became chief of test. He continued his studies at the Durham College of Science, Newcastle-on-Tyne, and later at the Heriot Watt College, until his health gave way. A series of sea voyages followed, during which he served as electrician or in other capacities. In 1902 he became assistant to Messrs. Carruthers & Elliot, consulting engineers to the West Australian and New South Wales Governments, and was engaged on important inspection work in Germany and Switzerland.



The late Mr. C. F. Mackness

He subsequently joined the A.E.G. of South Africa, Ltd., and as that company's assistant manager was entrusted with many important missions, visiting the United States, Mexico, South Africa and Rhodesia. In 1914 he became assistant manager of the Electrical Department of Vickers, Ltd., and in 1919 he formed and became chief engineer of their Hydro-Electric Department. Later he was chief of the company's General Engineering Department. In 1923 he commenced business as a consultant, and his firm of Mackness & Shipley carried out many important works at home and abroad, including hydro-electric works in Nigeria and Colombia, mining and dredge electrification work in Nigeria and Malaya, and steam power station work in South Africa and Australia. Mr. Mackness leaves a widow and son.

Miss M. Desmond.—We regret to learn from the Automatic Coil Winder & Electrical Equipment Co., Ltd., that Miss M. Desmond, a member of the company's staff, was one of the passengers who lost their lives in the accident to the air liner *Apollo* in Belgium last week.

Sir Robert Gibson, whose death occurred on Monday last at the age of sixty-nine, had many business interests in Australia. In addition to being chairman of the Commonwealth Bank, and a director of a number of companies, he was a member of the Victoria State Electricity Commission.

Mr. J. C. Eaton, of Cookham and District Electricity Corporation, Ltd., and formerly of the Brentwood District Electric Co., Ltd., was killed in a motor accident on December 21st. He was thirty-eight years of age.

Mr. R. M. Carr.—The death occurred on Christmas Day, after a short illness, of Mr. Robert Marshall Carr, electrical engineer and contractor, of Macclesfield. His work included important undertakings at Maidstone, Bexhill, Leek, and Macclesfield.

Mr. T. Wainwright.—The death occurred on December 26th, at the age of eighty-three years, of Mr. Timothy Wainwright, Southport. He established in 1875 the business of Timothy Wainwright & Sons, Ltd., electricians, &c., Southport.

Dr. K. Zickler.—The death recently occurred at Brunn, Czechoslovakia, at the age of seventy-two years, of Dr. Karl Zickler, for many years Professor of Electrotechnics at the German Technical High School, Brunn.

Mr. G. R. Talbot.—The death is announced, at the age of forty-eight years, of Mr. G. R. Talbot, who was on the works staff of the British Insulated Cables, Ltd., at Helsby for about twenty-two years.

Mr. W. Laws.—The death occurred on December 16th, at the age of fifty-seven, of Mr. Walter Laws, chief meter inspector of the Fleetwood Electricity Department.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Patrick & Holt, Ltd.—Private company. Registered December 23rd. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, electrical goods, gramophones, and domestic appliances and utensils, &c. The directors are: H. H. Patrick, "Nor-Mar," Maney Hill Road, Sutton Coldfield; A. E. Holt, "Tresco," Warwick Road, Olton. Registered office: 246a, Corporation Street, Birmingham.

Pencoed & District Radio Relay Co., Ltd.—Private company. Registered December 29th. Capital, £1,000 in £1 shares. Objects: To carry on the business of a radio relay company. The first directors are: A. J. Dando, "Sunnybank," Pencoed, Glam: and F. J. Williams, "Brooklands," Pencoed. Registered office: The Relay Station, Pencoed.

Electromech Power Transmission Co., Ltd.—Private company. Registered December 22nd. Capital: £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, and transmission engineers, &c. The first directors are: J. Vreeken, 168, Albion Road, Stoke Newington, N.16, M. S. Illingworth, The Vicarage, Shepherdswell, near Dover, and G. A. Cooper, 213, Windmill Road, Gillingham, Kent. Registered office: 31, Church Walk, Albion Road, Stoke Newington.

Agence Debrie London, Ltd.—Private company. Registered December 22nd. Capital: £1,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in cinematograph, gramophone, wireless telegraph, television and electrical machinery and apparatus, &c. The directors are: G. N. Westfield, 17, Charlotte Road, Wallington, Surrey, and E. J. Day, 61, Brook Road, Newbury Park, Essex. Solicitor: J. R. Borer, 235, Regent Street, W.1.

A. V. Caldwell, Ltd.—Private company. Registered December 22nd. Capital: £1,000 in £1 shares. Objects: To carry on the business of electricians, electrical, aeronautical, mechanical, automobile and general engineers, manufacturers of and dealers in electrical signs and devices, wireless transmitting and receiving sets, &c. The subscribers are: A. V. Caldwell, 29, Maitland Road, Woodthorpe, Notts, and S. F. Smith, 1, Hampden Street, Nottingham. Secretary: S. F. Smith. Registered office: 27/37, Burton Street, Nottingham.

Cliffdown Electrical Appliances, Ltd.—Public company. Registered December 23rd. Capital: £14,000 in 12,000 7½ per cent. participating preference shares of £1 each and 16,000 ordinary shares of 2s. 6d. each. Objects: To acquire the business of Brice (Electrical), Ltd., 41-44, Castle Hill Road, Hastings, as electrical plant, fitting and equipment manufacturers, &c. The directors are: J. E. L. Brice, 63, London Road, St. Leonards-on-Sea, and P. E. Croucher, 37, Wykeham Road, Hastings, (directors of Brice (Electrical), Ltd.). Registered office: 42, Castle Hill Road, Hastings.

Eastern Telegraph Co. (France), Ltd.—Private company. Registered December 27th. Nominal capital: £40,000 in £1 shares. Objects: To carry on in France or any of its present or future colonies and dependencies and elsewhere the business of telegraphists, telephonists, receivers, transmitters, and distributors of speech, music, sounds, signals, news, intelligence, and printed or visual or pictorial matter, &c. The subscribers (each with one share) are: J. C. Denison Pender, 65, Eaton Place, S.W., Sir Norman Leslie, Bt., Petres Field, Penshurst, Kent, and Lord Inverforth, The Hill, Hampstead, N.W. The company must always be and remain under British control and no person other than a British subject (except the Marchese G. Marconi) shall be qualified to hold office as a director. Registered office: Electra House, Victoria Embankment, W.C.2.

British Electric Utilities Investment Trust, Ltd.—Private company. Registered December 27th. Nominal capital: £100,000 in £1 shares. Objects: To acquire and hold shares, stocks, debentures and securities of or guaranteed by any British, colonial or foreign company, and in particular those of an electric light and power company, or securities of any Government or authority (but not to acquire shares, obligations or investments for the purpose of earning a profit by the realisation thereof), &c. The subscribers are: F. Greenfield and A. V. Palmore, both of 6, Austin Friars, E.C.2. Solicitors: Grundy, Kershaw, Samson & Co., 6, Austin Friars, E.C.2.

Returns of Electrical Companies

Mouldings, Ltd.—F. E. Bendall, of Midland Chambers, Warwick Passage, Corporation Street, Birmingham, ceased to act as receiver on December 20th, 1933.

Ely Gas and Electricity Co., Ltd.—Particulars filed of £5,060 debentures authorised November 22nd, 1933, charged on the company's undertaking and real and personal chattels, present and future, the amount of the present issue being £500.

Pontypool Electric Light & Power Co., Ltd.—Issue on December 15th, 1933, of £2,100 debentures, part of a series already registered.

Ionlite, Ltd.—Debenture dated December 15th, 1933, to secure £1,300, charged on the company's property, present and future, including uncalled capital. Holders: F. V. Trust, Ltd., 6, Broad Street Place, E.C.

L. Weekes (Luton), Ltd.—Capital, £6,000 in £1 shares. Return dated July 20th (filed August 4th), 1933. All shares taken up. £6,000 considered as paid. Mortgages and charges, £3,000.

Ellis & Ward, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1. Return dated October 16th, 1933. 1,000 preference and 6,003 ordinary shares taken up. £1,003 paid on 3 ordinary and 1,000 preference shares. £6,000 considered as paid on 6,000 ordinary shares. Mortgages and charges, nil.

John Dugdill & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 4th, 1933. All shares taken up. £3 paid. £9,997 considered as paid. Mortgages and charges, £3,000.

Plessey Co., Ltd.—Debenture dated December 6th, 1933, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital, and ranking *pari passu* with an existing debenture. Holders: Branch Nominees Ltd.

Aron Electricity Meter, Ltd.—Capital, £350,000 in £1 shares. Return dated July 31st, 1933. 75,968 shares taken up. £75,968 considered as paid. Mortgages and charges, nil.

Neon Manufacturers, Ltd.—Mortgage debenture dated November 22nd, 1933, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Wm. R. Bertram, The Red House, Midhurst, Sussex.

Jersey Electric Lighting & Power Co., Ltd.—Capital: £65,000 in 51,000 preference and 14,000 ordinary shares of £1. Return dated August 25th, 1933. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid. Mortgages and charges: Nil.

Horley & District Electricity Supply Co., Ltd.—Capital: £50,000 in £1 shares. Return dated March 28th (filed October 13th), 1933. 20,640 shares taken up. £18,640 paid, £2,000 considered as paid. Mortgages and charges: Nil.

Thermalux Electrical Products, Ltd.—Debenture dated December 14th, 1933, to secure £750, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Sykes, 16, Westborough Drive, Halifax.

J. B. Saunders (1923), Ltd.—Capital: £5,000 in 1,000 preference and 4,000 ordinary shares of £1 each. Return dated June 5th (filed October 17th), 1933. 795 preference and 4,000 ordinary shares taken up. £4,795 paid. Mortgages and charges: Nil.

City Notes

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., held its annual meeting on December 28th, when Mr. B. H. Binder (chairman), in the course of his speech, said that another year of transition had gone by, and its results showed some improvement, but were still disappointing. The net result for the year was a loss of £48,200. The principal part of the loss was incurred in the first half of the year, and, although the seasonal improvement in turnover which took place during the second half was more marked than in the previous year, it was not sufficient to absorb the losses already incurred. In fact, their total sales for the year were somewhat less than in the preceding year. The reduction in the share capital had enabled the value of the fixed assets to be written down and the various balance-sheet items not represented by assets, and particularly the heavy debit balance on profit and loss account, to be written off, including the loss shown for the year. With regard to Persan, although the loss had been reduced, the expectations of the management had not been fulfilled, but a final decision as to the course to be adopted in connection with this factory had been deferred until their British Goodrich associates had had an opportunity of studying the situation on the spot. Last year he was a newcomer on the scene, and as he became acquainted with the details of the company's operations he was firmly convinced that not only did it require financial assistance owing to the depletion of its resources by continued losses, but that more than anything else it required strengthening in management. He had been able to negotiate with Sir Walrond Sinclair the agreement between the two companies which formed the basis for the capital reorganisation scheme, and without which that scheme would not have been possible. They were now controlled by the British Goodrich Rubber Co., Ltd. Sir Walrond Sinclair had joined the board, and immediately the meeting was over he (Mr. Binder) was resigning his position as chairman and would propose the election of Sir Walrond Sinclair to the chairmanship. He would, however, remain on the board. An arrangement had already been made for the British Goodrich Co. to take over their empty Burton factory, which was thereby converted from a burden of expense into a source of income; but it was at Silvertown and in the general organisation that a wider scope would be found for the effective aid of the British Goodrich Co. In these days, when manufacturers and producers were faced with the fact that a particular trade or industry had a productive capacity in excess of the effective demand, it required a statesmanlike view of the situation as a whole for one company which was doing well to refrain from adding to the total productive capacity, and, instead, to assume the more laborious duty of taking over the control of existing concerns, which, while having the capacity, required reorganising and modernising. This was an example which should encourage others in the industry to work for co-operation and careful planning rather than unregulated competition, which could only result in uneconomic prices for a time, which was not in the ultimate interests of the consumer, the industry, or the community.

The Young Accumulator Co. (1929), Ltd.—Presiding at the annual meeting held on December 29th, Mr. B. E. Ronaasen (chairman) in the course of his speech said that the extra expenditure during the past year on sales efforts and advertising was some £5,000 greater than that expended upon sales efforts in the preceding year. This expenditure was bearing fruit, and the first three months of trading for the current year had wiped out the trading loss and for the first time in the history of the company it was on a satisfactory net profit-earning basis. They had been perturbed by the unfair competition caused by the mushroom growth of battery repairers and assemblers due to the flooding of the market with cheap plates, and with the help of their agents had launched their special exchange scheme which had considerably increased the demand for their batteries. They were now able to offer their products in every part of Great Britain, combined with an efficient service, and also in many parts of the British Empire. It was proposed to alter the date for the closing of the accounts each year to March 31st; the next balance would, therefore, represent a trading period of only seven months.

The Anglo-Portuguese Telephone Co., Ltd., is offering 123,908 ordinary shares of £1 each at 23s. per share to holders of ordinary and "A" ordinary shares, in the proportion of approximately one new share for every seven held. The new shares will rank *pari passu* with the existing ordinary shares, but will not be entitled to participate in any final dividend which may be declared in respect of 1933. The purpose of the issue is to pay off a loan of £120,000 incurred in developing the company's business and to replace it by permanent capital. The directors report that it is estimated that the increase in stations in 1933 was about 8 per cent., while the revenue is being satisfactorily maintained.

The Northampton Electric Light & Power Co., Ltd., has given notice of its intention to repay the £463,000 of 5 per cent. debenture stock on July 1st next at 105 per cent. The company proposes to issue £450,000 new 3½ per cent. debenture stock at 96 per cent. redeemable at par on July 1st, 1964, with the option to redeem the whole or any part at six months' notice on or after July 1st, 1944. Holders of the existing stock are invited to convert their holdings into an equal amount of the new stock, and in this event will receive on July 1st next a cash payment at the rate of £9 per £100 of stock converted.

The Great Northern Telegraph Co., Ltd. (of Denmark), has declared an interim dividend of 2½ per cent. for the second half of 1933. Two interim dividends of 2½ per cent. each have been paid in respect of 1933. For 1932, interim dividends totalling 5 per cent. were paid, followed by a final dividend of 7½ per cent., and a bonus of 7½ per cent., making a total distribution of 20 per cent. for the year.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved: Amalgamated Electric Lamp Manufacturers, Ltd.; Northampton Radio, Ltd.; Radio Research, Ltd.; Strombo Electric Co., Ltd.; Yorkshire Electrical Agency, Ltd.

The Ebonite Container Co., Ltd., has declared an interim dividend of 2 per cent. No interim dividend was paid for 1932-33, but the final distribution was 4 per cent.

E. K. Cole, Ltd., has declared an interim dividend of 10 per cent. on the ordinary shares. No ordinary dividend was paid for the period of sixteen months to May 31st last, but a distribution of 40 per cent. was made for 1931-32.

Stocks and Shares

TUESDAY EVENING.

THE starting-up of Stock Exchange business after the New Year was marked by a continuance of the firm tone that characterised most of the markets during the closing weeks of 1933. The January disbursement of dividends brought in the customary demand for investment suggestions into which some of the money could be diverted. With no fresh issues of magnitude to absorb money that is flowing into the Stock Exchange markets, prices of the existing securities were advanced under the pressure of the persistency of demand. A year ago, it would have seemed as though prices of electricity supply shares had reached something like their zenith, having regard to the comparative modesty of yield which they even then afforded, and the limited scope for increased income which at that time they offered. Nevertheless, the current prices show a general improvement over those of twelve months back. This was illustrated in our tables of a week ago. Since then, further gains have been secured by leading shares in both the London and the Provincial groups.

Capital and Industry

The interest of the public in Stock Exchange markets is wider to-day than it has been for years past. However illogical it may be, on paper, for gilt-edged securities to improve at the same time as shares in the industrial groups are advancing into favour, the fact remains. There is practically no indication that the trade improvement now taking place in most branches of British industry will exert an unfavourable effect upon the prices of gilt-edged securities. The money required by industry is being obtained in directions other than those which would entail the realising of British Government and similar stocks.

Public Boards Stocks

In the market for the stocks of the Public Boards, London Passenger Transport issues show further gains upon those secured just before Christmas. The 4½ per cent. "A" and the 5 per cent. "B" stocks are both better at 116 and 123 respectively. The recent rise in the price of the speculative "C" stock served to bring in a few profit-takers, with the result that the price has receded to 84. Central Electricity stocks are unchanged. Recent notification by the Board that it intended to apply for fresh borrowing powers was interpreted in some quarters as a hint that a new issue might be coming in the early future. Inquiries in well-informed circles resulted, however, in there being no confirmation obtainable of such an intention—at all events at the present time.

London Electricity Supply Shares

Mention has already been made of rises in the list of ordinary shares in the London electricity supply companies. The majority now stand at levels that give a return of little more than 4 per cent. on the money. In spite of this, however, the demand persists. Chelsea shares have risen to 34s. 6d., Metropolitans to 56s. 3d. Several lines of shares that were on offer, and attention to which has been called here lately, have been lifted from the market, with the result

that the available supplies are extremely scarce. In the Provincial group, Lancashire Light & Power strengthened to 36s. 3d., Midland Counties to 40s., and North-Eastern Electric ordinary to 37s. 6d., the last named showing an advance of a florin. The Scottish shares are also in request. Clyde Valleys and Scottish Power advancing to the common price of 42s. 6d. The recently issued Scottish Power preference shares remain a good market at 4s. 9d. premium.

West Gloucester preference has risen to 104; the ordinary stock reacted to 67½ after being higher. West Devons are firmer at 26s. 3d. Richmonds (Surrey) spurted to 58s. 6d.

Stocks on Offer

It may be of use to mention that there are 1,000 Electrical Finance & Securities ordinary shares on offer at 67s., the yield at this price, on the basis of the last-paid 12½ per cent. dividend, being £3 14s. per cent. Newcastle & District Electric Lighting ordinary shares can be bought, as to 1,000 or so, at 37s. 3d., the yield here, on the basis of 7 per cent. dividend paid in each of the last three years, being 3¾ per cent. The dividends are paid once a year, in March. A few hundred Northampton Electric Light & Power ordinary are on offer at 55s. 6d., giving a return of £3 12s. per cent., and with a half-year's dividend due in February. The company has announced its intention to pay off its 5 per cent. debenture stock in July next at 105, and to replace this, at the holders' option, with a 3½ per cent. debenture stock offered at 90.

Electric and General

The Electric & General Investment Company, which paid no dividend on its ordinary capital in each of the last two years, has convened a meeting for January 4th for the purpose of consolidating the capital. The 6 per cent. preference shares of £5 each are quoted at 3¾ ex dividend. The last bargain officially marked in the shares was at 78s. 9d., on September 5th, 1933.

Atlas ordinary opened this year, at 8s., but eased off to 7s. 9d. British Power & Light shares remain steady at a shade above 20s.

Cables and Wireless

Slightly better prices are quoted for the preference and the "A" ordinary stocks of Cables & Wireless. Market opinion in regard to the outlook appears to be that until overseas business improves, the traffics of the combine are not likely to enjoy any particular expansion. On the other hand, it is recognised that the Board of Trade returns, showing increases in exports and in imports, imply an improvement in trade outside this country. Such a factor should be reflected in the takings of the communication companies. The market for the time being is in a somewhat hesitant mood, though if there were to be any material change for the better in the monthly ratio of receipts the stocks would be likely to respond promptly. Marconi Marines hold their rise at 30s., and Canadian Marconis are 8s. 4½d. Globe ordinary and preference maintain their improved positions. American Telephone & Telegraph stock is steady at 109½; International Telephone & Telegraph at 14¼. The message which President Roosevelt is to broadcast on the Wednesday in this week is awaited with unusual interest, expectation looking for some kind of definite clue as to the goal at which the President's policy is aimed, so far as the currency problem is concerned.

The Great Northern Telegraph Company has declared an interim dividend of 2½ per cent., and the price went ex the 5s. on Tuesday in this week.

Manufacturing and Equipment

After a period of quiescence, absorption of shares in the construction and equipment companies is again making itself apparent. Amongst the prices that have risen since a week ago are British Insulated at 75s., Callenders at 65s., Enfield at 95s., Henleys at 6¾. So keen is the investment appetite nowadays for industrial shares of good class that would-be buyers experience considerable difficulty in obtaining what they require. Crompton Parkinsons are better at 22s. 6d. Enfield Rolling Mills keep steady at 31s. 6d. Siemens 10 per cent. preference strengthened to 35s. 9d. Ericsson Telephone ordinary rose 1/6 to 63s., and the 7 per cent. preference are a trifle better at 28s. Johnson & Phillips 4½ per cent. debenture at 101 is ex dividend, and so also is Pirelli-General Cable 4¾ per cent. debenture at 107. Hall Telephone Accessories at a guinea, London Electric Wire Co. & Smith's ordinary at 18s. 6d., and Telegraph Condenser ordinary at 23s., while nominally unchanged, are all rather better in tone. Chloride Electrical Storage "A" and "B" shares are quoted at the common price of 2 9/16.

Miscellaneous Matters

Victoria Falls & Power ordinary shares are 7s. 6d. better at 5½. Part, at least, of the buying has come from the Cape. The preference are 41s. 3d. A fairly general advance has lifted rubber prices, the produce leading the share market. Iron, steel and allied issues are mostly higher, with Babcocks 2s. up to two guineas, and Vickers being wanted at 9s. 3d. Amongst new issues, Anglo-Portuguese Telephone are 2s. 6d. premium. These were offered to shareholders at 23s. The company's old shares stand at 26s. 3d. ex rights.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1931.	1932.	Price, Jan. 2.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	78/3	—	3 17 0
Brompton Ordinary	1	8½	7	34/–	—	4 2 4
Charing Cross Ordinary	1	8½	7	34/6	—	4 1 2
Chelsea	1	8½	7	34/6	+6d.	4 1 2
City of London	1	10	10	35/–	—	4 0 0
Clyde Valley	1	7	7	42/6	+⅛	3 5 10
County of London	1	10½	10½	57/6	+⅛	3 13 0
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	47/6	—	3 15 9
Elec. Supply Corporation ...	1	11	11	80/–	+⅛	2 15 6
Kensington Ordinary	1	8	7	34/6	—	4 1 2
Lancs Light and Power	1	7	7	36/3	+⅛	3 17 2
London Electric	1	9	7	34/6	—	4 1 2
Metropolitan	1	10	10	56/3	+¼	3 11 5
Midland Counties	1	7	7	40/–	+⅛	3 10 0
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary	1	6	6	37/6	+2/–	3 4 0
Do. 7% Pref.	1	7	7	34/–	—	4 2 4
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	13¾	—	4 8 11
North Met. Elec. 6% Pref. ...	1	6	6	30/–	—	4 0 0
St. James' and Pall Mall	1	8	7	34/6	—	4 1 2
Scottish Power	1	8	8	2¼	+⅛	3 15 4
South London	1	8½	7	34/6	—	4 1 2
Westminster Ordinary	1	8½	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	47/6	—	3 7 3
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	113	—	4 8 6
Do. 1955–75 ...	,,	5	5	114	—	4 7 6
Do. 1951–73 ...	,,	4½	4½	106	—	4 5 0
Do. 1963–93 ...	,,	—	3½	93	—	3 15 3
London & Home Counties, 1955–75	,,	4½	4½	108xd.	—	4 3 4
London Passenger Transport, A...	,,	—	4½	116	+½	3 17 7
Do. do. B...	,,	—	5	123	+2	4 1 6
Do. do. C...	,,	—	—	84	–1	—
West Midlands Joint Elec. 1948-68	,,	—	5	114	—	4 7 6
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	109½xd.	—	8 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	114	—	5 5 3
Do. Def.	,,	1½	1½	29½	—	5 1 8
Cables & Wireless 5½% Pref. ...	,,	2¾	2¾	74½	+1	3 13 10
Do. A 7½% Ord.	,,	Nil	Nil	24	+¾	—
Do. B Ord.	,,	Nil	Nil	10½	—	—
Globe Tel. and T. Ord.	10	Nil	2½	10	—	2 10 0
Do. do. Pref.	10	6	6	12	—	5 0 0
Great Northern Tel.	10	20	20	32½xd.	—	6 4 0
Marconi-Marine	1	10	7½	30/–	—	5 0 0
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 18 4
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	450	—	—
Do. do. Pref. Ord.	,,	8	8	144½	—	5 10 9
Brazil Traction	100	—	—	11	—	—
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	102½	—	4 17 7
Mexico Trams, 5% Bonds ...	—	5	5	22½	—	22 4 4
Mexican Light Common	100	Nil	Nil	5½	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	40	—	12 10 0
Victoria Falls Ord.	1	15	20	5½	+⅛	3 12 9
Yorkshire (West Riding) ...	1	Nil	Nil	15/–	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	4	4	17/9	—	4 10 4
Do. Pref.	1	8	8	31/3	—	5 2 5
Babcock & Wilcox	1	14	9	42/–	+2/–	—
British Aluminium Ord.	1	5	5	28/–	+9d.	3 11 5
British Insulated Ord.	1	15	15	75/–	+½	4 0 0
Brush Ord.	Stock	Nil	Nil	40	—	—
Callender's	1	15	15	65/–	+⅛	4 12 4
Do. 6½% Pref.	1	6½	6½	30/9	—	4 4 6
Crompton Parkinson Ord. ...	5/–	22½	12½	22/6	+⅛	—
Do. 8% Pref.	1	8	8	31/3	—	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/–	—	—
Enfield Cable Ord.	1	25	25	95/–	+½	5 5 5
English Electric	1	Nil	Nil	7/6	—	—
Do. do. Pref.	1	Nil	Nil	11/3	—	—
Ever Ready	5/–	35	35	20/–	—	6 0 8
Ferranti Pref.	1	7	7	28/–	—	5 0 0
G.E.C. Pref.	1	6½	6½	31/–	—	4 3 10
Do. Ord.	1	8	8	42/6	—	3 15 3
Henley's	1	30	30	6⅛	+⅛	4 17 1
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	15/–	—	—
Johnson & Phillips	1	5	5	18/9	—	5 6 7
Siemens Ord.	1	7½	6½	20/–	—	—
Telegraph Construction	£1	Nil	Nil	28/9	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1932

6277. "Electric gas and vapour arc discharge lamps." Dr. R. Zaddach. March 3rd, 1931. (402747.)

6966. "Electrical signalling apparatus." W. C. Davey. February 25th, 1933. (402842.)

13337. "Protective arrangements for parallel-connected alternating-current feeders or other apparatus." General Electric Co., Ltd., and W. Wilson. May 9th, 1932. (402800.)

13357. "Thermally operated electric switches." Edison Swan Electric Co., Ltd., and H. E. Lines. May 9th, 1932. (402801.)

14624. "Electric timing apparatus especially for use in elevator control." Igranic Electric Co., Ltd. May 21st, 1931. (402750.)

15165. "Methods and apparatus for use in telegraphic signalling systems." H. J. J. M. de R. de Bellescize. May 29th, 1931. (402780.)

15233. "Alkaline electric storage batteries." Drumm Battery Co., Ltd., and R. H. D. Barklie. May 28th, 1932. (402752.)

15328. "Cathode-ray tubes." Siemens-Schuckertwerke Akt.-Ges. May 30th, 1931. (402781.)

15443. "Inductance coils." A. C. Cossor, Ltd., J. E. Blackshaw and F. C. Robinson. May 31st, 1932. (402767.)

15754. "Detector circuit for wireless reception." Hazeltine Corporation. March 31st, 1932. (402773.)

15995. "Electric motor control." British Thomson-Houston Co., Ltd., H. F. Jefferson and R. D. Given. June 6th, 1932. (402760.)

16024. "Delay-action mechanism applicable to electric switches." F. Downes, W. D. Rogers, C. J. Cooke and G. B. Bowell. June 7th, 1932. (402787.)

16223. "Electric motor control for hoisting apparatus and the like." International General Electric Co., Inc. June 8th, 1931. (402815.)

16380. "Permanent magnets." W. Jessop & Sons, Ltd., and J. E. Gould. June 10th, 1932. (Cognate application 6249/33.) (402821.)

16423. "Electrical impedance networks." Standard Telephones & Cables, Ltd. June 13th, 1931. (402823.)

16470. "Electrical signalling systems." Automatic Electric Co., Ltd., and F. McCabe. June 10th, 1932. (402827.)

16472/74 and 16476. "Pressure-wave transmitters and receivers incorporating magneto-strictive devices." Marconi International Marine Communication Co., Ltd., and N. P. Hinton. June 10th, 1932. (402828/31.)

16570/1.—"Directional radio beam systems." Federal Telegraph Co. July 29th, 1931. (402834/5.)

16592. "Telephone systems." Automatic Electric Co., Ltd., and R. Taylor. June 11th, 1932. (402837.)

16603. "Electrical connections." J. Lucas, Ltd., and W. H. Egginton. June 11th, 1932. (402839.)

16806. "Loud speakers." G. T. Allen. June 14th, 1932. (402847.)

17041. "Methods of simultaneously transmitting a large number of independent electric currents through a single channel." T. J. D. Craig. June 16th, 1932. (402855.)

17265. "Protective arrangements for electric circuits or apparatus." G. H. Scholes & Co., Ltd., G. H. Scholes and F. J. Pearce. June 18th, 1932. (402860.)

17650. "Tuning of electrical circuits." Six-Sixty Radio Co., Ltd., and D. P. Wheeldon. June 22nd, 1932. (402868.)

17785. "Electric incandescent lamps." E. Caddy and S. C. Caddy. June 23rd, 1932. (402869.)

20882. "Payment-collecting devices for use with electricity or gas supply meters and the like." J. R. P. Lunn, A. V. Boothroyd and T. Summerson & Sons, Ltd. July 25th, 1932. (402884.)

22940/1. "Electrical make-and-break contacts and method of making same." W. W. Triggs (P. R. Mallory & Co., Inc.). August 16th, 1932. (402893/4.)

26486. "Electric welding torches." British Thomson-Houston Co., Ltd. September 24th, 1931. (402910.)

28936. "Means for operating electric high-frequency furnaces." Allmänna Svenska Elektriska Aktiebolaget. June 9th, 1932. (402791.)

30181. "Liquid-break electric switches." International General Electric Co., Inc. October 27th, 1931. (402927.)

34841. "Methods of operating electric discharge devices." International General Electric Co., Inc. December 8th, 1931. (402937.)

36355. "Oil-break electric switches." International General Electric Co., Inc. December 29th, 1931. (402942.)

1933

1269. "Diesel-electric vehicles." Sulzer Frères Soc. Anon. February 1st, 1932. (402950.)

5965. "Thermionic amplifiers." Telefunken Ges. für Drahtlose Telegraphie. February 25th, 1932. (402964.)

6519. "Electrolytic cells, e.g., electrolytic condensers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 5th, 1932. (402967.)

8428. "Oscillatory systems suitable for use in wireless signalling and for similar purposes." Marconi's Wireless Telegraph Co., Ltd. March 19th, 1932. (402978.)

8646. "Switches operated by fluid pressure for controlling electrical circuits." W. W. Groves (Briggs Manufacturing Co.). August 16th, 1932. (Divided application on 22971/32.) (402980.)

9061. "Automatic volume control for wireless receivers and the like." Hazeltine Corporation. April 6th, 1932. (402981.)

10593. "Electric induction furnaces." Electric Furnace Co., Ltd. April 30th, 1932. (402988.)

11349. "Thermo-responsive electric switches." J. F. Schmidinger. April 19th, 1932. (402989.)

11589. "Liquid-break electric switches." International General Electric Co., Inc. April 20th, 1932. (Addition to 402927.) (402990.)

11714. "Systems of electric motor control." British Thomson-Houston Co., Ltd. April 22nd, 1932. (402991.)

12825. "Electric discharge valves and grid electrodes for use therein." Telefunken Ges für Drahtlose Telegraphie. May 2nd, 1932. (403003.)

14188. "Apparatus for examining bodies by means of X-rays or other radiation." C. H. F. Muller Akt.-Ges. May 20th, 1932. (403010.)

15597. "Cathode-ray apparatus." International General Electric Co., Inc. May 30th, 1932. (403018.)

19092. "Device for determining the position of vessels by means of Röntgen rays." T. F. Westenholz. July 5th, 1933. (403037.)

19540. "Suppression-layer photo-electric cells and processes for the manufacture of the same." F. Rother. July 8th, 1932. (403041.)

23002. "Gas-blast electric switches." British Thomson-Houston Co., Ltd. August 17th, 1932. (403055.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 27th :—

Dralowid. No. 540728. Class 8. Electrical resistances, potentiometers, condensers, microphones, chokes and other wireless components, voltmeters, ammeters, &c.—Steatit Magnesia Gesellschaft, Berlin. (British representatives : Gill, Jennings & Every-Clayton, 51-52, Chancery Lane, W.C.2.)

Eltrazon (lettering and design). No. 542881. Class 11. Mercury-vapour quartz lamps for curative purposes.—Eltrazon, Ltd., 54, Queen Anne's Gate, Westminster, S.W.1.

Swimming-bath Water Sterilisation

AT the new medical school at St. Mary's Hospital, Paddington, London, a scheme of treatment by ultra-violet rays of the swimming-bath water has been adopted and operated for about six months with conspicuous success. The water now in the bath is that with which the bath was initially filled, and it is at present clearer and freer from bacteria than it was originally, although the bath has been in constant use.

While the bath is in use the water is continuously circulated through a purification system in which is embodied ultra-violet ray, aeration, filter, and heating equipment. The water from the bath first passes through a strainer and then, in turn, through a centrifugal pump, a shingle-bed filter, a steam heater, and aerator, and through ultra-violet ray units and then back to the bath.

The circulation system is in operation continuously while the bath is in use, but it has been found that two hours' ultra-violet ray treatment per day is sufficient to sterilise the water. The bath holds 56,000 gal., and the water is circulated at 240 gal. per minute, so that there is a complete change in roughly every four hours. The circulating pump is driven by a 5-h.p. Laurence, Scott motor, which also drives a small air compressor on the other end of its shaft, this compressor feeding the aerator.

There are four ultra-violet ray units in the system arranged as two banks of two, one pair working in parallel at a time, with the other two as stand-by. Each unit consists of an outer shell somewhat similar to the chest of a low-pressure steam valve, with suitable flanges for connection in the pipe system. In the centre there is a 6-in. diameter quartz cylinder around which the water flows top and bottom. Inside this cylinder is the actual ultra-violet-ray lamp. Thus when the lamp is "on" the water passing around the quartz cylinder is irradiated.

The lamp itself embodies a non-tilting mercury vapour tube with a small electric heater at one end to vaporise the mercury at starting. It is also equipped with cooling fins. The lamps are supplied at 440 V, d.c., by a 12-A motor-driven generator. Not only is the water irradiated, but the lamps also treat the air fed to the aerator; before being received by the compressor the air actually passes through the quartz tubes, thereby cooling the lamps and at the same time being irradiated. At the top of each unit is a flanged ruby sight glass which affords easy inspection and cleaning of the interior.

An important feature of the system as a whole are the measures which have been adopted to ensure efficient and thorough circulation of the whole of the water in the bath and to avoid stagnant patches, so that the resultant sterilisation is both regular and complete. The system was designed and installed by Messrs. Mumford, Bailey & Preston, Ltd., for whom the actual equipment was made, and the electrical installation work in connection with the scheme and with the building as a whole was carried out by Messrs. Higgins & Griffiths, Ltd.

Some illustrations of the equipment appear on page 15.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Angus.—Houses (100); James McGregor, county architect, Municipal Buildings, Forfar.

Aylesbury.—Houses (52); borough surveyor. Houses (74), Clinton Crescent, for H. C. Janes, Ltd.

Ayr.—Houses (438), Braehead and Lochside; John Young, burgh surveyor, Town Buildings. Hospital (£200,000); Medical Officer.

Bardney (LINCS).—Canning factory for A. W. Foster & Co., Ltd., Lincoln.

Berwick-on-Tweed.—Houses (300), for Councillor J. Ayre.

Bexley Heath.—Cinema (electrical work), for Sidney Bacon's Pictures, Ltd.; J. T. Ellingham, Ltd., builders, Spital Street, Dartford.

Birmingham.—Houses (50), Sarehole Road, Hall Green; F. T. Matthews, builders, Trinity Road, Handsworth.

Bolton.—Houses (36), Compton Way, and 26 houses, Hall Wood Estate; borough engineer. Houses (54), Ferns Estate; J. Gerrard & Sons, Ltd.

Bradford.—Houses (54), Carr Bottom Road; J. Priestley, Calder Bank, Penrith Avenue, Morecambe and Heysham.

Brownhills (STAFFS).—Houses (50); U.D.C. surveyor.

Carlisle.—Central schools, the Swifts, for City E.C.; director of education.

Chatham.—Swimming and slipper baths; borough surveyor.

Chelmsford.—Extensions to factories for the Hoffmann Manufacturing Co., Ltd.

Cleveleys.—Cinema, Victoria Road (£25,000), with electrical work; G. Tonge, architect, National Provincial Bank Chambers, Lord Street, Southport.

Coventry.—Houses (150), Stoke Aldermoor Estate (£43,685); city engineer. Extensions to premises, Swan Lane, with electrical work; Ives & Rushby, builders, Swan Lane.

Crewe.—Clinic and child welfare centre and handicraft and domestic subjects' centre (£8,398), for Borough E.C.; director of education.

Cumnock.—Houses (140), Barrs Park; R. Forbes, burgh surveyor, Town Hall.

Darlington.—Houses (63) and Town Hall; E. Minors, borough engineer.

Deal.—Senior schools, Mill Road, for Borough E.C.; Mr. Barker, architect, King Street.

Dundee.—Extensions, Dental Hospital, including research laboratory and new mechanical laboratory; superintendent.

Durham.—School, Harworth, for County E.C. (£8,479); A. E. Earnshaw & Sons, builders, Darlington. Schools, Lanchester, for County E.C.; R. Gallacher, Ltd., builders, Blackhill. Schools, Kibblesworth, Shotton, and remodelling, Auckland Park Council School (£2,400); F. Willey, architect, 34, Old Elvet.

Eastbourne.—Clinic, Avenue House (£12,700); G. Bainbridge & Sons, Ltd.

Edinburgh.—Houses (324), Restalrig, and 54 houses, Ferry Road and Easter Warriston; E. J. McRae, city architect, City Chambers, Edinburgh. New Government Buildings; Thomas S. Tait, architect.

Essex.—Two elementary schools, Hornchurch, for County E.C. Staff cottages, Severalls Mental Colony, Colchester (£18,000), and extensions, Romford Institution (£7,500), for County P.A.C.; J. Stuart, county architect, Chelmsford.

Eynsford (KENT).—Houses, Lullingstone Castle Estate; John D. Wood & Co., Berkeley Square, London.

Fifeshire.—Houses (148), for Lochgelly; J. T. Scobie, architect, Dunfermline.

Flintshire.—Central school, Bryn Coch, Northop Road, Flint, for County E.C.; E. W. Gittens, builder, Aberderfyn, near Wrexham.

Gosforth (NORTHUMBERLAND).—Alterations and additions to the Gosforth Hotel; S. H. Lawson, architect, Emerson Chambers, Newcastle-on-Tyne.

Hamilton.—Houses (1,900), Udston Farm; W. H. Purdie, burgh surveyor, Municipal Offices.

Hartwoodhill (LANARKSHIRE).—Hospital for the mental defectives (£250,000); clerk, County Council, Hamilton.

Headington (OXFORD).—Houses (50), Windmill Road; Langley Development Co., Ltd., Slough.

Hebburn-on-Tyne.—Houses (50) for U.D.C.; T. A. Page & Sons, architects, 67, King Street, South Shields. Maternity home for the Governors of Hebburn Hall Infirmary (£4,000).

Hemel Hempstead (HERTFORDSHIRE).—Extensions to institution, for the P.A.C. (£21,183); E. Mills, builder, Beaconsfield.

High Wycombe.—Houses (500), Kingcote Estate, Wycombe Marsh; Bryce, Ltd., 80, London Road.

Hove.—School (280 places), Knoll Estate, for Borough E.C.; director of education.

Hull.—Cinema at the corner of Holderness Road and Lake Drive for the Ashford Trust, Ltd., 56, Victoria Street, London, S.W.1; Markwell, Holmes & Hayter, Ltd., 198, Albert Avenue.

Ilford.—Cinema, Eastern Avenue (electrical and heating work); G. Coles, architect, Craven Street, London, W.C. Embassy cinema, Chadwell Heath, with dance hall and café; A. E. Reeve, Brooklands, Chadwell Heath. School (700 places), Fencepiece Road, for Borough E.C.; director of education.

Jedburgh.—Houses (70), Old Bongate and Queen Street; John Innes, burgh surveyor, County Buildings.

Kent.—Operating theatre, Bromley Institution, with emergency lighting set (£2,500); clerk, Maidstone. Schools, Northfleet, and Hectorage Road, Tonbridge, for County E.C.; director of education, Maidstone.

Kenton (MIDDLESEX).—Cinema and shops, Kenton Road; Odeon (Kenton), Ltd.

Kilmarnock.—Maternity home (£22,000); burgh surveyor.

Kingston-on-Thames.—Schools (£12,000), for Borough E.C.; director of education.

Lanarkshire.—Extension, Bishopsbriggs Public School for County E.C.; John Stewart, county architect, 20, Albert Street, Motherwell.

Lancashire.—Houses for attendants, Ribchester Institution (£3,650), for County P.A.C.; county architect, Preston.

Lancaster.—Extensions to Co-operative Stores for the Lancaster and District Co-operative Society, Ltd. (£26,000), with electrical installations; Thompson & Morris, builders, Queen Street.

Leeds.—Cinema at the junction of Chapel Street and Primrose Road, Halton, for H. T. Jones, "Lodore," Halcyon Hill, Chapel Allerton; Chadwick & Watson & Co., architects, 9, Albion Street.

Leven.—Houses (68); Robert J. Wigston, burgh surveyor, Carberry.

London.—(FINCHLEY).—Shops, Market Place; Second Hampstead Tenants, Ltd. (LEWISHAM).—School, Honor Oak Estate; L.C.C. architect.

Mansfield.—Rebuilding premises, Market Place, for Messrs. Boots Cash Chemists, Station Street, Nottingham; Henry James (Mansfield) Ltd., builders, Central Joinery Works, Station Street.

Manchester.—Houses (91), Chapman Street, Elsden Drive and Pennington Street, Gorton; F. W. Woolfenden & Co., builders, 204, Hamilton Road, Longsight.

Middlesbrough.—Houses (96), near Acklam Hall; E. T. Sweeting, builder, Haymore Street, Linthorpe. Houses (114), Green Lane; W. A. King & Son, builders, North Ormesby. Houses for H. D. Lerick, "Willerby," Linthorpe. Church, North Ormesby; S. H. Clarke, architect, 89, Grange Road. Branch library, Marton Grove Estate (£3,000); S. E. Burgess, borough engineer.

Motherwell.—Reconstruction of old High School (£44,000); Murdoch, McKenzie, Ltd., builders.

Musselburgh.—Houses (600); John Logan, burgh surveyor, Municipal Buildings.

Newcastle-on-Tyne.—Houses, Fossway; Tyne Housing Development Co., builders, Benton Road, Benton. Alterations to St. Margaret's Hotel; L. J. Coures and Partners, architects, Carliol House. Rebuilding of the Town Hall (£198,000); city engineer.

Northampton.—Houses (54), Abington Estate, and flats, Dallington Road; borough engineer. Houses (68), Penrhyn Road; J. C. Wareing.

Oldham.—Houses (282); borough surveyor.

Paisley.—Houses (3,000); James Lee, burgh surveyor, Municipal Buildings.

Perth.—Church, Kinnoull Street, for the United Free Church (continuing); J. and J. W. Lyall Bowie, solicitors.

Rauceby.—Extensions to mental hospital, including nurses' home, convalescent homes, and patients' villa (£50,000), for the Joint Visiting Committee.

Rawtenstall.—Houses (120), five years' rehousing; borough engineer. Houses (50), Land End Farm; Abel Heap.

Renfrew.—Houses (63); Arch. Allan, burgh surveyor, Municipal Buildings.

Rochford.—Extensions to institution, for Southend-on-Sea P.A.C.; R. H. Dyer, borough surveyor.

Romsey (HANTS).—Houses (66); R. Jenvey, borough surveyor.

Rugby.—Houses, Addison Road; borough surveyor. Automatic telephone exchange, Albion Street, for H.M. Office of Works; James Grey West, chief architect, Architects' Department, Storey's Gate, Westminster, S.W.

St. Ives (CORNWALL).—Houses (45); borough surveyor.

Sandbach.—Extensions to works for C. J. Jennings & Sons, Ltd., Crewe Road; W. H. Smith & Co. (Whitchurch), Ltd., builders, Whitchurch, Salop.

Sheerness.—Houses (36); U.D.C. surveyor.

Skegby.—Houses (54); L. Dodsley, R.D.C. architect, Portland Chambers, Sutton-in-Ashfield.

Smethwick.—Reconstruction of Crocket Lane School (£8,392); borough engineer.

Spalding.—Business stores, Market Place, for Montague Burton, Ltd., Leeds.

Stirling.—Houses (375), the east side Bannockburn Road; A. H. Goudie, burgh surveyor, Municipal Buildings.

Stockton-on-Tees.—Secondary school for boys, with electrical installations; F. Willey, 34, Old Elvet, Durham.

Stoke-on-Trent.—Houses (800), Stanfields, Longton, Stone and Meir (£300,000); Amos Burton, city surveyor, Town Hall.

Sunderland.—Houses, Fulwell Estate; Bell Bros., builders, Cleveland Road. Houses, Sidcliffe Park Estate; E. and J. Purvis, builders, Garcia Terrace. School, Spelterworks Road, for County E.C.; Gordon Durham & Co., builders, East Baldon.

Surrey.—Schools, Stoneleigh Park Estate, Ewell, for County E.C.; secretary, Kingston-on-Thames.

Tynemouth.—Administration block at the Moor Park Hospital (£19,400); J. L. Beckett, borough engineer, North Shields.

Twickenham.—Houses (36), Crane Way, and 51 houses at Hall Farm Drive; H. M. Grellier & Son, architects, Palace Chambers, Bridge Street, S.W.1. Houses (187), Fulwell Park Estate; Wates (Streatham), Ltd., Streatham, S.W. Film studios at the rear of present studio; Twickenham Film Studios, Ltd.

Wealdstone.—Cinema and café, High Street and Bruce Road; Odeon (Wealdstone), Ltd.

Welwyn (HERTS).—Houses (60); Burgess & Read, builders, Watford.

West Hartlepool.—X-ray department (£1,500); F. Durkin, architect, Municipal Buildings.

Whiston.—Central fire station (£4,615); U.D.C. surveyor.

Whitley Bay.—Bathing pool (£35,000); A. J. Rousell, U.D.C. surveyor.

Wigan.—Church, Ormskirk Road, Brindley Road, for the trustees of the Zion Independent Methodist Chapel; Clough & Gaskell, Ltd., builders, Billinge Road Saw Mills.

Worsley.—Houses (44), Greenheys site, Little Hulton; J. Gerrard & Co., Ltd., builders, Swinton, Manchester.

Worthing.—Houses (40), Angola Road; Payne & Linfield.